SCIENCE

NEW SERIES.
VOL. VI. No. 153.

FRIDAY, DECEMBER 3, 1897.

SINGLE COPIES, 15 CTS.
ANNUAL SUBSCRIPTION, $5.00.

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CONTENTS:

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N Y.

THE UNITED STATES FISH COMMISSION.

ACCORDING to law the United States Fish Commissioner must be a man of 'proved scientific and practical knowledge of the fishes of the coast.' If President McKinley judges that Mr. Cleveland violated the law in appointing to the position the cousin of a prominent Democratic politician, having no previous scientific knowledge or practical experience in the work, retired from the navy owing, it is said, to rheumatism, aggravated by sea air, and if further the incumbent has not during the past two and a-half years acquired 'scientific and practical knowledge of the fishes of the coast,' then it is the President's duty to remove the present Commissioner and make a new appointment according to the requirements of the law.

We think that the President could best secure information on the subject by appointing a committee of men of science to make a report on the conduct of the Fish Commission during the past two and a-half years. The National Academy of Sciences is the legal adviser of the government on scientific questions, and a commission consisting of President Gibbs, Mr. Agassiz and President Jordan could make a report, the

conclusions of which would be final. It is our belief that freedom of thought and action and permanent tenure of office are so important for the advancement of science that no scientific officer, whether of a university or under the government, should be removed except on the ground of incompetence publicly proved.

President McKinley may, indeed, judge that incompetence in the present Commissioner has been publicly proved by his record prior to his appointment and by his conduct of the Commission, and if he has reached this decision it would be hard to question its justness. The appointment was unfortunate, as is admitted by every one; and while the Commissioner has since learned somewhat of the practical work of hatcheries, it does not appear that he is willing to take scientific advice in regard to the conduct of the Commission. It must also be remembered that the education of the Commissioner, as far as it has progressed, has been very expensive, costing the government perhaps as much as to train a hundred young men until they were competent to fill the position.

Apparently the efforts of the Commissioner have hitherto been directed to collecting the largest possible quantity of eggs in order that he may announce the numbers in his annual reports. Thus the last annual report states that 128,000,000 lobster eggs have been collected during the year, being an increase of 46,000,000 over the numbers for 1895. We are not, however, told how many of these eggs were killed at the hatcheries, and the Commissioner is probably not aware that in taking the eggs from the hen lobster he materially interfered with their chances of survival. Scientific research has demonstrated that the lobster in berry, whose capture is prohibited by law, can care for the eggs far better than would be possible in any hatchery. To collect them as is done is analogous to taking all the babies born in New York City and depositing them in a baby farm. It is true that much might be accomplished by collecting the eggs in regions where they are abundant and depositing the young where the lobster has been nearly exterminated; but the Commissioner states explicitely 'that he believes in following nature as closely as possible, by depositing the young on the ground from whence the eggs are taken.'

Even at present the Fish Commission is performing a useful work in some directions, such as the distribution of shad fry, with results that more than repay the entire expense to the government of the Commission. But it is now living, not on income, but on capital. The scientific knowledge of the development, life histories and habits of fishes acquired when the Commission was directed by Baird, by Goode and by MacDonald is being used, but not increased. The efficiency of the hatcheries and of methods of distribution cannot be advanced or even maintained, and it is impossible to extend the work in needed directions, as to the oyster. It would be ignoble to depend on the work of foreign nations and investigators, even were it directly applicable to the conditions of our coast. But, indeed, the present Commissioner has not the knowledge to 'convey' what he cannot

earn. It is reported that recently, when he claimed that the station at Woods Holl was the greatest biological station in the world because it hatched the largest number of fry, he was reminded of the Naples station, but replied that he had not heard of it.

The station at Woods Holl, made by Baird, Goode and MacDonald a center of research, fruitful in practical applications, regarded as a model by other nations, has now fallen into disrepute. The institution has been practically closed to investigators. The present Commissioner is apparently unable to appreciate what such a station means and what great practical benefit might proceed from it. Scientific research and the applications of science are but the obverse and reverse of the same coin, and he who expects to do without one side of the coin will find that he has none left in his pocket.

Now since the Coast and Geodetic Survey has been reformed by the present administration, only the Fish Commission needs its attention. When Mr. Cleveland was Governor of New York he vetoed the bill for the continuation of the Geological Survey of the State, and when President he occasionally showed that he had too long postponed his university training. The present administration is, however, in full sympathy with the scientific departments of the government, and is competent to decide whether the present Commissioner meets the requirements of the law, and, if not, to appoint a Commissioner of 'proved scientific and practical knowledge of the fishes of the coast.'

THE NATIONAL ACADEMY OF SCIENCES.

THE autumn meeting of the National Academy was held this year in Boston, beginning at 11 a. m. on Tuesday, November 16th, and continuing until Thursday afternoon. The attendance of members was unusually large for an autumn meeting, about thirty being present at one time or another during the three-day session. The absence of some members residing almost within sight of the place of meeting was a noteworthy indication of a lack of great interest in the leading scientific organization of the country. The program of papers offered was also unusually long and varied, nearly every department of science being represented. While all of these contributions were valuable and taken together represented a large amount of original investigation, none could be considered as unusually or unexpectedly important or strikingly novel in character or results.

The session opened with Professor Woodward's paper on 'The Mass of the Earth's Atmosphere.' The general conclusions of interest were that the radius of the atmosphere was probably five or six times that of the earth, and that while its mass could not exceed five per cent. of that of the earth it was probably not more than one millioneth as much. Professor Carl Barus presented the result of further studies of the effect of time on the temper of steel, the beginnings of which he had published some years ago. The lapse of years has served to bring out more clearly the interesting and important secular changes, the recent measurements having been made on the same specimens used in the earlier stages of the investigation.

This paper was followed by that of Dr. Mendenhall on 'Steel Knife Edges,' which was also a continuation of researches communicated to the Academy at previous meetings. The present investigation

consisted in the main of an examination of the behavior of steel knife edges under pressure and with varying angles. By observing the electrical resistance of the surface of contact of the pressure plate and the knife edge, the effect of pressures varying from zero to twenty thousand pounds was determined, the length of edge being about two inches. The superiority of the wide angle edges was clearly shown, confirming the conclusion reached in previous investigations. Professor O. C. Marsh next gave an interesting account of recent visits to the Russian museums, in which, greatly to his surprise, he found no examples of dinosaurs. He held, however, that they would yet be found in the district represented by these museums.

Professor Chittenden presented the results of an elaborate investigation of the effects of borac and boric acid on nutrition, and Dr. Minot, who was formally introduced as a new member by the President of the Academy, having been elected to membership at the April meeting in Washington, read an interesting account of embryological investigations in which he has been engaged. Professor W. A. Rogers gave the results of his last determination of the relation of the yard and meter, depending upon a recent comparison of his own standard with one of the new prototypes in the Office of Weights and Measures at Washington. Professor Morse presented important results of the study of the ancient molluscan fauna of New England and Professor Verrill discussed cannibalistic selection as a factor in evolution.

The session on Wednesday morning was devoted to the transaction of business, members only being admitted. The important event of the session was the formal acceptance, by the Academy, of the gift of $20,000 from Miss Alice L. Gould, daughter of the late Dr. B. A. Gould, one of the charter members of the Academy. Miss Gould had communicated her intention of making this gift in honor of the memory of her father and of his long connection with and interest in the National Academy, at the April meeting in Washington, but on Wednesday the deed of gift was formally presented, together with the conditions on which it was made and the names of the first trustees. Its acceptance was authorized by the Academy and the trust assumed. The income of the fund is to be devoted to the encouragement of astronomical research and its management is to be essentially like that of the Bache fund. The trustees selected by Miss Gould were Professor Boss, Dr. S. C. Chandler and Professor Asaph Hall.

In the scientific session that followed, Professor Hyatt reported progress in an interesting study in which he is engaged, upon the migration of land shells on the Hawaiian Islands. The material for this study had been obtained from an extensive collection of shells made by Rev. J. T. Gurlick while a missionary in the islands thirty or forty years ago. This collection had been so systematically made and the locations so carefully noted that Professor Hyatt was enabled to lay out on a relief model the various localities occupied by different species, and to indicate the paths along which their migrations must almost certainly have been directed.

This paper was followed by an exhibtion by Professor Michelson of his new harmonic analyzer, which he had brought from Chicago to show to the Academy. In the latest form of the machine eighty elements were included, and it appeared to be capable of producing results correct to within about one per cent. The machine was put in operation, and its work, both in analysis and synthesis, was greatly admired. Mr. C. L. Norton presented by invitation a description of new apparatus, one for thermometer comparisons and the other for determining the heat of combustion.

A paper by Dr. Weir Mitchell and Alonzo H. Stewart, on the 'Action of Venom of Crotalus Adamanteus Upon the Blood,' was read by Dr. Bowditch.

On Thursday there were further contributions by Professors Verrill and Marsh. Professor Cross, on invitation of the Council, presented a paper on the 'Wave Siren,' and S. C. Chandler discussed the agreement of 'The Theory of the Motion of the Pole with Recent Observations.' There was also a paper by Major Powell, 'An Hypothesis to Account for Movements in the Crust of the Earth,' and Professor Emmons gave an account of the International Congress of Geologists at St. Petersburg.

As might well be expected, the social features of a meeting of the Academy were not lacking. A number of academicians availed themselves of the opportunity to hear the last of the course of lectures on 'Tides' by Professor George Darwin, at the Lowell Institute, the final lecture of the course being on Tuesday evening. There was unusual interest in the reception on that evening, at the home of Mrs. Professor W. B. Rogers, whose husband was for several years and at the time of his death the President of the Academy. Similar courtesies were extended to members on Wednesday and Thursday afternoons, and on Wednesday evening Professor Trowbridge described and exhibited his new 10,000-cell storage battery and high-voltage apparatus.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE 18th annual and 36th regular meeting of the American Society of Mechanical Engineers was held in New York, beginning on November 30th. This Society, now seventeen years old, numbers nearly two thousand members, including substantially all mechanical engineers of the United States. Its transactions are always rich in valuable technical facts and data and are usually so extensive as to fill a large annual volume.

The principal papers of the present session were the following:

Mr. F. W. Dean summarizes the progress of improvement in reducing the 'Cost of Steam Power' from 1870 to 1897; showing that the gain has been between thirty and forty per cent. He attributes this saving to the following: 37% to higher steam-pressure and ratios of expansion, multiple-cylinder engines, steam jacketing and drying or superheating the steam; 5% to the use of vertical engines; 7% to improved boilers; 7% to economizers heating the feed water; 2% to improved grates. The weight of steam used per horse-power per hour has fallen from 20 to 12.5 pounds, as minima for the dates given. He finds the compound engine the usual and on the whole most successful form of engine and gives valuable data relating to its efficiency and the costs of power where it is employed.

Professor Carpenter presents the results of 'Tests of Centrifugal Pumps' and 'Calibration of a Weir' at Chicago, where the unique opportunity was presented of making such determinations on an exceptionally large scale, and of checking the standard formulas for discharge perhaps more accurately than ever before on anything approaching so large a scale. The conclusion is reached that the Weisbach formula is more exact than the Francis, under such circumstances, and that it is best employed without allowing for 'end-contraction.' The great centrifugal pumps, of usual form, gave efficiencies rising to above 60 per cent.

Dr. Thurston, in conjunction with Mr. Brinsmade, read a paper on 'Multiple Cylinder Engines and Effects of Variation of Loads,' in which the experimental investigation of the relative efficiencies at various loads was determined for the standard 'compound' and 'triple expan-

sion' engines and for the peculiar form of engine produced by omitting the intermediate cylinder from the latter, thus producing a machine with abnormally high ratio of cylinder-volumes, as successfully employed by Rockwood. A wide range of load was adopted and the result is found to be an efficiency, in the case of the novel form of engine, intermediate between that of the triple-expansion and that of the standard compound, approaching the efficiency of the latter as maximum expansions and minimum loads are approximated. We may be able to give later a fuller abstract of this paper.

Mr. W. S. Keep details a series of experiments upon 'Cast Iron under Impact,' in which he shows some very singular and puzzling phenomena, such as the increase of the strength of the metal by simply smoothing its surface, variation of the resistance and of the elastic limit by such alterations of its superfices, and similar hitherto unsuspected modifications of its molecular characteristics by this method of strain.

Mr. George Richmond offers a study of 'Thermodynamics without the Calculus,' in which he develops in an interesting and peculiarly helpful manner the method of Professor Gibbs in the application of the temperature-entropy system of coordinate, thermodynamic geometry. The paper is presented in compliance with the request of members of the Society in the course of a discussion during the preceding meeting.

Mr. Charles T. Main gives a very unique paper, on the 'Valuation of Textile Manufacturing Property;' which important but greatly neglected department of technical literature has peculiar interest to the capitalist and the economist as well as to the engineer. This study is in great detail, and its writer is an acknowledged expert.

Mr. Fletcher submits an account, given by the inventor, who is still living at a ripe old age, of the invention and introduction of the Stevens Valve-Gear for steam engines, universally employed for many years past on the 'American river-boat engine.' It is an interesting and valuable contribution to technical history.

Other papers, numbering in all over twenty, are contributed by as many members, each expert in his own department, and affording material for another valuable volume of transactions.

The next meeting will probably be at Niagara Falls.

PRESIDENT GILMAN ON THE RELATIONS OF SCIENCE AND COMMERCE.

At the annual banquet of the Chamber of Commerce in New York, November 23d, the chairman, Mr. Alexander E. Orr, called upon President Gilman, of Johns Hopkins University, to respond to this sentiment, *Commerce the Child of Science and its filial Supporter.* The substance of Mr. Gilman's remarks is indicated in the following report:

Let me give some striking illustrations of the impulse that Commerce has received from Science; but let them all be drawn from present times, at least from days with which many men in this assembly are personally familiar.

Without astronomy there could be no sure navigation of the open sea. The great observatories, with their able masters and their powerful lenses, are revealing to human intelligence the celestial mechanism, and are making every year more accurate the nautical almanacs—those guides to the heavens, so sure and so important that we may almost call them 'The Pilots' Bible.' It is to the science of naval architecture that commerce owes the marvelous improvements which have transformed the packets of the 'Black-ball' line and the Baltimore clippers into the iron steamers of to-day. The size, materials, forms, structure, of seagoing ships, both men-of-war, protectors of

commerce and the great liners of the ocean, are the results of careful study, by able men in quiet hours, devoted to the ascertainment of accurate knowledge.

It is the science of mechanics which has developed the steam engine for the feeble motor, plied by Fulton on the Hudson, into the triple and quadruple expansion engines which now propel these enormous steamers, to and fro, across the ocean, with a regularity almost as sure as the swinging of a pendulum.

Geographical science has studied every portion of the globe and opened to commerce the continents of Africa and Australia, and the islands of Japan and Oceanica, closed to Europeans before the days of Wilkes, Perry, Stanley and other explorers.

It is to hydrography that commerce owes the accurate surveys of coasts, channels and harbors, initiated in this country by the Blunts, those once famous New Yorkers, and those surveys of the ocean depths which made possible the laying of the Atlantic Cable.

Physics has well fulfilled its part by the improvements introduced into the construction of the mariners compass, the propelling screw, the perfection of light houses, the introduction of fog signals, and the ever advancing development of electro-magnetism, most significant, far reaching, revolutionary and serviceable of all modern discoveries.

Meteorology, a branch of physics, grows more accurate every year and is interpreting and foretelling the course of winds and cyclones.

Almost all these advances lie in the field of mathematics.

Cancel these gifts of science. Restore electricity to the excitement of a bit of amber, bring back the quadruple expansion engine to the tea-kettle from which it has been evolved, reduce the nautical almanac to a deliniation of 'the Dipper,' and destroy the charts on which reefs and shoals are carefully indicated to the rude outlines of even fifty years ago—and where would commerce be?

Now let us change our point of view and see how these obligations have been met. With open-handed munificence, with horns of plenty filled with the products of every clime, Commerce, the child of Science, has been her generous supporter. Rapidly glance at the record.

It was an East Indian merchant

> Born in America, in Europe bred,
> In Africa travelled and in Asia wed

made those gifts to the collegiate school in New Haven, which have given renown for almost 200 years to the name of Elihu Yale. The last half century has been prolific in kindred gifts. It was a merchant of Mobile who founded the Sheffield Scientific School in New Haven; a merchant of Boston who gave his name to the Lawrence Scientific School in Cambridge; a merchant of New York who established the John C. Green School of Science in Princeton; a merchant of Brooklyn whose gifts to Cornell University surpassed the founder's; a business man of Philadelphia who founded the Towne School of Science; a merchant of New Orleans whose name is recalled by Tulane University; and a merchant of Baltimore, Johns Hopkins, who divided his fortune between a university and a hospital.

Just so with modern libraries in this country. John Jacob Astor, a merchant of New York, set the example, soon to be followed by Lenox and Tilden. Joshua Bates, a partner of the Barings, rendered a like service to Boston, and William Brown, one of the Brown Brothers, to Liverpool. The museums at Cambridge and New Haven attest the scientific interest of George Peabody, who founded a library in Baltimore. Chittenden, of New York; Pratt, of Baltimore; Newberry, of Chicago, each one a mer-

chant, and a great many more, are the builders of libraries, which Carlyle once called 'the true universities.' When Western learning is needed in Turkey and the Levant, it is a merchant of New York who founded Robert College, near Constantinople, and another merchant, William E. Dodge, and his associates, who established the Syria College of Beirut. When it was a question of Arctic research Henry Grinnell and George Peabody equipped the expedition of Kane and his successors, and when a museum of natural history was required, or a gallery of fine arts, it was from the members of this chamber that support was secured. Thus commerce generously has contributed to the maintenance of learning. Is it not that the pursuit of commerce broadens the mind? To promote among the nations of the earth those exchanges which benefit alike the buyer and the seller enlarges human sympathy. The study of the world's resources, requirements and conditions of prosperity produces wisdom, courage, forethought and generosity.

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*PRIMITIVE MAN IN THE DELAWARE VALLEY.**

INTRODUCTORY.

A few years ago, as a result of extended explorations, conducted by the Bureau of American Ethnology, questions were raised with reference to the soundness of the then existing evidence relating to glacial man in the Eastern States, and the correctness of the conclusions drawn from it. Since that time, until quite recently, investigation has progressed slowly and but little has been brought forward likely to change the status of the case. Now, however, strong claims are being made of the discovery of new and confirmatory evidence of antiquity, and discussion is invited with a view of determining its merits; but before taking up this phase of the subject it is desirable that the earlier phases of the investigations be passed briefly in review.

The questions raised by me were not those of the age of man in America. I have always taken the view that the race must have occupied this continent for a very long period. Great antiquity is clearly proved by facts derived from other than archæologic or geologic sources. It does not require argument to show that the development of many well differentiated nations and tongues means a prolonged occupation. It does not take argument to demonstrate the proposition that, notwithstanding the potent influence of local environment upon human art and effort, a thousand distinct cultures could not spring up in a day.

The only questions I have ventured to discuss and the only ones that now claim my attention are as to whether the evidence already brought forward to demonstrate the antiquity of man on the Atlantic slope will stand the test of scientific scrutiny. There is a record of man in the valleys and among the hills throughout the entire country. There is an important record in the geological formations of the Delaware valley. Has the key to this record been discovered? Has the true combination been worked out, or are our pioneer investigators struggling through a phase of this particular research corresponding to that encountered by the predecessors of Champollion in the reading of the Egyptian hieroglyphs? The earlier readings at Trenton seem to indicate possibly three distinct peoples and periods of occupation, referred to by some as paleolithic, Eskimo and Indian; but are we sure of more than one and are the others mere figments of the imagination? Time will tell, but this year or the next may not finally decide it.

*Read at the Detroit meeting of the American Association for the Advancement of Science.

THE ALGONQUIAN OCCUPATION.

The first step in acquiring a knowledge of the past is to seek to understand the present. An acquaintance with the historic peoples of a region is the best key to the prehistoric peoples. In the study of the question at issue in the Delaware valley correct method demands that we look first to known conditions for explanations of all doubtful phenomena. The only occupants of this region known to us were a group of Indian tribes of what has come to be known as the Algonquian stock. The history of these tribes, as dimly shadowed forth by tradition and archæology, extends back indefinitely into the past. They were found by the whites living in villages, cultivating corn, navigating the waters, hunting, fishing and warring; weaving simple fabrics, practicing the potter's art in its most primitive form, and employing stone as the chief material for implements and weapons. They used metal to a very limited extent and employed shell, bone and wood in various arts. Their culture status is made clear by actual observation of the peoples themselves, as well as by a study of the relics of many village sites known to have been occupied by them. The local tribes, the Leni Lenape, had relatives of like culture extending along the coast from Carolina to Maine and from the mouth of the St. Lawrence to the head of the Great Lakes. They had neighbors of other stocks, all occupying about the same simple level of neolithic culture. Researches long continued in the whole vast territory occupied have developed no definite trace of other people or other conditions of culture. No one can say how long they had been here or whence they came, but their coming was doubtless long ago. Wandering bands pushed their way over the hills or along the shores and gradually took possession of this beautiful region. One group, known to us as the Delawares, occupied the Delaware valley, adopting it as a permanent home. Their dwellings were established along the banks of the rivers and creeks; they multiplied and spread, and, being an active and enterprising race, gradually acquired a knowledge of the resources of the country, and especially of the varied mineral products, which were of the utmost importance to their welfare. On local sites they worked the varieties of stone available for implements. They dug them out of the loose deposits of the stream beds and bluffs. They advanced into the hills and mountains, and little by little discovered the deposits of desirable rock in place, and quarried deeply into the bowels of the earth. The work of search and exploration was so thorough that nothing escaped them, and the archæologist looks with amazement on the still existing evidences of their energy in quarrying argillite, jasper and soapstone.

The stones available to such a people in the earlier periods of their occupation would be the loose cobbles and masses of the rivers and bluffs. In the Trenton region the only material well fitted for flaking—the chief shaping process of the early days—was argillite, a compact slaty-looking rock especially plentiful in some parts of the glacial gravels. It follows that on and about the margins of the glacial terraces flaking at first dealt chiefly with this material. The beds of argillite found in place farther up the valley would next be utilized and later the flints and jaspers of the distant uplands would be discovered and used. How long it was from the time of the first occupation to the period of complete exploration and utilization of resources thus outlined no one can guess. It may have been 500 or it may have been 5,000 years. During this prolonged period the work of shaping stone implements went on. The raw material was sought and worked up with a persistence and energy that might

almost be regarded as a foreshadowing of the vast mining and manufacturing industries of to-day. The knives, scrapers, drills, projectile points, etc., the implements upon which everything in the savage economy depend, were roughed out, specialized and carried away, and the refuse in vast quantities, consisting of flakes, fragments and failures representing all stages of development, was left upon the ground. The rejectage must have been especially plentiful along the bluffs at Trenton, where the argillite was found in the shape of bowlders and partially worn masses, and in the valleys and hills above, where it occurs in place. The rude rejected forms left upon these sites were large or small, long or short, according to the shape of the implement made and the nature of the material used. They were rough or well developed according to the stage of the shaping process at which they were cast aside. No type of flaked stone has been found in the whole region that was not necessarily produced again and again and for centuries along the banks and bluffs of the Delaware by these historic peoples, and in the course of years and geologic mutation it is readily seen that this rejectage of implement making would become intermingled in various ways with the superficial deposits of the sites of manufacture. Every bank that crumbled, every grave dug, every palisade planted, every burrow made, every root that penetrated and every storm that raged took part in the work of intermingling and burial; and following in turn came the resettling, the leeching-out and the recementing of these deposits, making it difficult to distinguish the old from the new. It follows, therefore, that the student of the history of this valley, and especially of that part of it recorded in the soil and superficial deposits, should not for a moment lose sight of these conditions and events of recent and comparatively recent history, and should seek first to explain all phenomena from the point of view thus afforded before conjuring up shadowy images of other races.

INVESTIGATION IN THE GLACIAL GRAVELS PROPER.

It happened, however, that before the investigation of the phenomena referred to above and now so definitely assigned to the Algonquian peoples had begun to attract the attention of archæologists the presence of other people had already been assumed. Evidences of very primitive paleolithic races had been associated with glacial formations abroad, and the glacial deposits of the Delaware region were accordingly searched with the hope of finding similar traces. Relics of art were soon secured, and as they were rude and exclusively of flaked stone they were regarded as supporting the theory of a glacial paleolithic man. A large body of evidence was soon accumulated and passed into literature without particular scrutiny.

When, finally this subject came into prominence and questions began to arise as to the determinations made, it was found that the flaked stones which formed the exclusive evidence furnished, though rude as reported, were not of special or peculiar types, such as seem to characterize paleolithic times abroad, but that they corresponded in every particular with the ordinary rude work, and especially with the rejectage of manufacture, of the Algonquian and other American tribes; and it happened further that they were found along the very bluff faces where argillite bowlders outcropped and where the Indian tribes had naturally resorted to secure the raw material and block out their implements; then it came to be asked whether the finds had really been made in the true gravels, whether they were not obtained from deposits associated with the gravels but not belonging, in their present deposition, to

the glacial age; such deposits as accumulate in depressions, or along the faces of bluffs and banks subject to crumbling and sliding. When later it was realized that the questions involved, the nice discriminations to be made in collecting this evidence, were really geologic rather than archæologic a new phase of the investigation was initiated and geologists were asked to participate in the examinations. It was imperatively demanded that the gravel should be re-examined and the evidence sifted and placed on a safe footing. In meeting this demand for re-examination of their evidence the advocates of an American paleolithic man have claimed that the criticisms made were to be classed with those encountered by Boucher de Perthes when he began to present his evidence regarding early man in Europe; that such criticisms meet every advance of thought. But the cases are by no means parallel. The discoveries of Boucher were not acceptable because of their revolutionary character with respect to accepted beliefs. On the other hand, the Trenton determinations were popular and almost universally accepted as final until attention was called to the true nature of the objects found, and especially to the unsatisfactory methods pursued in collecting evidence. The climax came when it was understood that the advocates of a glacial paleolithic man were gathering all classes of rudely flaked stones from the surface of the country generally (entirely disregarding an Indian occupation) and employing them to establish a peculiar theoretic culture for America.

It was not conservatism, and especially it was not conservatism in religious thought, that led such men as Powell, Brinton, McGee, Chamberlin, Salisbury, Mercer, Mason and others intimately acquainted with the field of investigation to seriously question the methods and the evidence. The charge of conservatism must rather be urged against

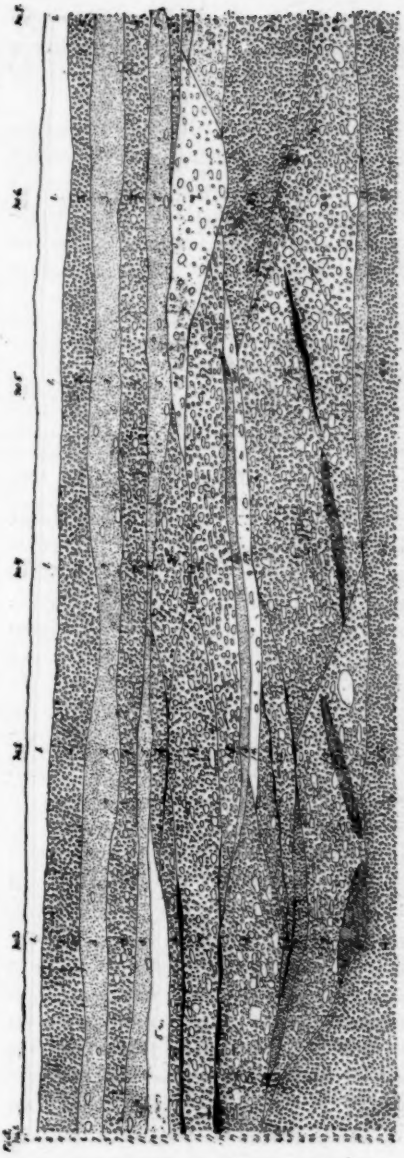

FIG. 1. Section of the Trenton gravels showing relation of productive to non-productive profiles.

those students who have held to their original views and especially against such scholars as Topinard, Boulé and Keane, who accept without serious scrutiny any evidence that tends to confirm accepted theories with respect to a uniform history of the race on both sides of the Atlantic.

Fortunately opportunities for a re-examination of the evidence have arisen in several cases. The principal discoveries of shaped stones attributed to the gravels were made in the slope of the bluff facing the river at Trenton (*A* in the section, Fig. 1) and in the banks of Assanpink Creek at the point where the Pennsylvania railway makes its way from the station near the creek level to the terrace above (*B* in the section). Finds continued to be made in the crumbling river bank at *A* until accumulating city refuse covered up the deposits.

They ceased to be made in the creek banks at *B* as soon as the cutting extended fairly into the gravels in place; and when, in 1889, I asked the principal explorer of this locality why the finds had ceased, he replied that when the railway cutting was made the excavations were carried up through a depression that must have been an old stream bed, and that the finds were in the filling of this channel. I do not think he understood the significance of the admission, but the statement must have been true, as nothing whatever is to be found in the present excellent exposures of the true gravels. The position of his finds are indicated at *d* on the dotted original profile in the section, and the present utterly barren exposures, half a mile or more in length, are indicated at *e*.

Identical results have been reached on the river front *A*. In 1892 a great sewer trench, *C*, 33 feet deep, was cut, parallel with the river bank, at the very point where so many shaped stones had formerly been found. Though we kept up the search in this trench for five weeks as the work of excavation went on—the whole body of gravel being subjected to rigid examination—not a chip was found, not a trace of man. No other examination has been made that compares with this for thoroughness and length of time involved. The evidence thus furnished has been spoken of as negative and hence as unsatisfactory, but, in the continued absence of finds of implements at this and other points, it seems positive and convincing. The conclusion reached is that there must have been an error in the observations that could produce hundreds of flaked stones from obscure or partial outcrops at a given spot in a crumbling bank when not a trace can be found at the same point when the beds are fully exposed.

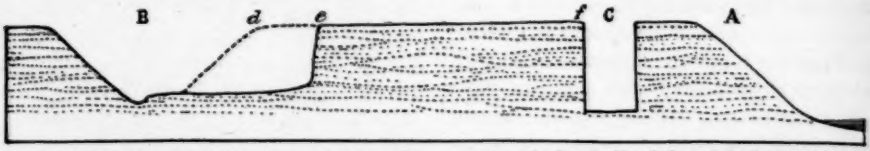

FIG. 2. Portion of section of gravels exposed in sewer trench, fac-simile of the original notes by Mr. Wm. Dinwiddie.

Geologists will be interested in seeing the detailed section made by my assistant in the trench. It tells the story of the deposits better than any other section that has been or probably ever will be made.

Considering the foregoing facts, it may be regarded as substantially proved that the glacial gravels proper contain no relics of art, and it would appear that now very few persons, indeed, expect them to yield any evidence whatever on the subject of human occupation. Five years have passed since the earlier observations and finds

were challenged, and in that time, so far as I have learned, no single implement has been reported from the gravels, although the exposures are as extensive as they ever were. The first chapter in the prolonged search for glacial man at Trenton may, therefore, be regarded as practically closed; but some new evidence furnished by examination of certain superficial deposits of sand come up for consideration. My remarks upon this subject will appear in a subsequent number of SCIENCE.

W. H. HOLMES.

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ON SOME IMPORTANT SOURCES OF ERROR IN THE PLANKTON METHOD.

THE Hensen method of plankton collection consists essentially in drawing a silk net vertically through the water. A part of the column of water traversed by the net is pushed aside, hence the actual catch must be multiplied by some factor to obtain the amount of plankton present in the given column of water. This factor, 'the coefficient of the net,' has been calculated by Hensen, for a series of velocities, from empirical data, and is applied uniformly to all catches without regard to the character of the plankton. The coefficient of the net used at the Illinois Biological Station, according to Hensen's formula, is 1.32 (velocity 0.5 meter per second). A series of field tests in which a column of water, similar to that traversed by the net was pumped and strained, indicates that the coefficient of the net varies with the amount and constituency of the plankton, ranging in the case of our net from 1.5 to 5.7. This variation is, in part at least, due to the increased clogging in the case of heavy planktons. The effect of the progressive clogging upon the coefficient is shown in a series of horizontal hauls of 5, 10, 15, 20 and 25 meters, which were made successively in similar water. The coefficient rose from 1.5 in the 5-meter haul to 4.83 in the 25-meter haul. A comparison of 15-meter hauls with those of 30 meters indicates that from 84% to 96% of the 30-meter catch is taken in the first 15 meters of the haul. Four places of decimals in a computed coefficient can hardly offer compensation for an error so fundemental as the variation in the straining capacity of the net. This error can be avoided by adoption of the pumping method and straining of a known quantity of water.

The plankton method as elaborated by Hensen and others depends upon the efficiency of the finest silk bolting cloth in removing the contained organisms from the water which it filters. It has been accepted by planktologists that the use of this cloth furnishes a satisfactory basis for the volumetric determination of the plankton and the enumeration of its constituent organisms. Hensen* (p. 75) states that the openings in the silk are so small that not many organisms can pass through them. Apstein† (p. 235) says: "With nets of this cloth almost all organisms are caught, only a few diatoms, which happen to meet an opening with their long axis, escape." Again‡ (p. 35) he maintains that almost all organisms are removed from the water by the use of No. 20 bolting cloth. No protest has been raised by our American workers§ || to these claims of the founders of the plankton method. The leakage of the plankton through the silk has thus been minimized or ignored, and without tests of the extent to which it occurs.

* V. Hensen. Methodik der Untersuchungen bei der Plankton-Expedition. Kiel und Leipzig. 1895.

† C. Apstein. Uber die quantitative Bestimmung des Plankton in Süsswassers: in Die Tier- und Pflanzenwelt des Süsswassers. Dr. O. Zacharias. Leipzig. 1891.

‡ Das Süsswasserplankton. Keil und Leipzig. 1896.

§ J. Reighard. A Biological Examination of Lake St. Clair. Lansing. 1894.

|| H. B. Ward. A Biological Examination of Lake Michigan. Lansing. 1896.

The bolting cloth (No. 20), when new, contains from 5,100 to 5,600 meshes per square centimeter, varying with the maker and the sample; when thoroughly shrunken the number of meshes increases as much as 30%. The total area of the openings in a square centimeter, on the other hand, decreases over 50%, falling from .133 to .066 sq. cm., and the average area of a single opening is reduced from .000024 to .00001. sq. cm. This latter figure represents an area of $32 \times 32\,\mu$, the average area of the openings at the maximum efficiency of the silk. These dimensions do not, however, constitute a precise limit to the size of objects which can escape through the openings, for many meshes exceed this area, and some even double it. The struggles of the imprisoned organisms and the pressure of the filtering water also materially assist the escape of the planktonts through the yielding meshes of the silk.

For the past year and a-half the leakage of the plankton through the silk has been a subject of experiment at the Illinois Biological Station. The results were at first so surprising as to require the most careful corroboration, and they have been witheld from publication in the hope that an adequate remedy might be offered therewith. Water from a number of sources, collected at different seasons of the year, and containing plankton varying in amount and constituency, has been subject to examination in several ways, and their relative efficiency determined by the Sedgwick-Rafter counting method. In order to reduce the error incident to this process, the enumeration of the planktonts was extended over from five to ten times the customary fraction of the catch. The leakage has been tested as follows: by the Sedgwick-Rafter sand filter; by hard-pressed filter paper; by the centrifuge, and by the Berkefeld filter. The silk catches were made from measured quantities of water, thus eliminating the uncertainty as to the amount of water which the drawn net filters. Tests were made of the filtrate from the silk, and also of the unfiltered water. Owing to diversity in the constituency of the plankton, the ratio of efficiency of these various methods cannot be precisely stated. In a general way the order above given is that of increasing efficiency. The silk, *in the pumping method of collection*, retains from 5% to less than 0.1% of the total *number* of organisms present (excluding bacteria), as contrasted with the catch of the Berkefeld filter.

The Sedgwick-Rafter sand filter was used according to the published directions of Calkins,* and later of Jackson† and Whipple‡. This method is far more efficient than the silk, but proved to be subject to considerable loss, especially in the case of water richly charged with plankton. Not only do the minute forms, as *Raphidium* and the smaller diatoms, readily slip through the sand, but also the more active species, as *Euglena* and *Trachelomonas*, escape in considerable numbers. Examinations of the filtrate from the sand revealed the fact that this method captures from 40% to 65% of the number of organisms present, the greater losses occurring with abundant planktonts.

The filter paper employed was No. 575 Schleicher & Schüll. It is very free from lint and does not easily tear when wet. As the filtering proceeds the plankton is condensed in the bottom of the funnel by means of a fine spray from a hand bulb. When the required condensation is reached the plankton can be washed from the paper by the

*G. N. Calkins. The Microscopical Examination of Drinking Waters. 23d Ann. Rep. Mass. Board of Health, for 1891.

†D. D. Jackson. On an Improvement in the Sedgwick-Rafter Method. Technology Quarterly, Vol. IX. 1896.

‡G. C. Whipple. Experience with the Sedgwick-Rafter Method. Ibid.

same means, care being exercised in removing the plankton quickly and thoroughly to reduce the loss occasioned by its adherence to the paper. This method is very simple, rapid, and, in my experience, more efficient than the sand filter, yielding from 75% to 85% of the planktonts.

The centrifuge at first employed was a small one having a capacity of 60 c. cm. Later, we had constructed for this work a large machine geared to give 3,000 to 4,000 revolutions per minute and arranged to act upon a continuous stream of water, all of which was subjected to the maximum and uniform action of the centrifugal force. This machine is more efficient than the filter paper, securing in some instances 98% of the planktonts. It is, however, subject to a selective error, in that the individuals and species whose specific gravity is the same as or less than that of the water are not removed by the action of the centrifugal force. Samples rich in water blooms proved to be most troublesome. *Anabæna* and *Clathrocystis*, as a rule, and many individuals of other genera, as *Euglena* and *Chlamydomonas*, readily pass through the machine. Water kept in the dark, or at low temperature, for some hours yields up such plankton more readily. The addition of alcohol to the water also facilitates precipitation. The most accurate results, however, were obtained after adding chloral hydrate to the water in quantities sufficient to kill the plankton. The selective character of this error, and its consequent uneven distribution in plankton varying greatly in the abundance of water blooms with the season and situation, render the use of the centrifuge of questionable utility as a basis for a complete analysis of the biologic contents of water.

The cylinders of the Berkefeld filter are made of 'infusorial earth' of such fineness as to remove effectually all solid matter from the water passing through them. The smallest cylinders were encased in a suitable mantle and attached to the centrifugal machine. The catch obtained in this manner contained from one-fourth to one-third more organisms than that of the filter paper, and was not subject to the irregularities resulting from the use of the centrifuge. This preliminary test was so promising that a larger form of the Berkefeld filter, known as an 'army filter, System Bruckner,' which has of late been introduced in the German and Austrian armies, was tried as a means of collecting plankton. It has the following advantages: its maximum capacity under favorable conditions is about two liters per minute; it is portable and can be used in the field; its simple construction favors the removal of the catch, and its capacity for filtration can be quickly renewed when it becomes clogged. At present it seems to offer the most effective method for the collection of the plankton which eludes the silk. It is, however, subject to one serious drawback; the removal of the catch from the filtering cylinder is accompanied by the addition of a considerable amount of the infusorial earth to the plankton. This renders the 'Danaid task' of counting doubly difficult and precludes volumetric determination. The desideratum for a filtering cylinder for this work is yet to be found. It should be an inexpensive porous earthenware cylinder whose outer surface is of sufficient fineness to preclude the penetration of minute organisms, and of a firmness sufficient to permit the removal of the catch with a stiff brush without disintegration. Experiments in this direction are now in progress.

This leakage of plankton through the silk is a matter of fundamental importance. A considerable volume of the contents of the water is lost at all seasons of the year, and in some instances the actual catch of the silk net is but a small fraction of the total plankton present. Filter-paper catches from a

variety of situations made at intervals throughout more than a year indicate that the silk net retains from one-half to one forty-fifth of the total solid contents of the water, the greater losses occurring from waters containing *Trachelomonas*, *Chlamydomonas*, *Euglena*, *Melosira* and other minute forms in abundance. The relative amount of silt is, however, much greater in the filter-paper catches than it is in those made with the silk, so that the actual volume of plankton lost is less than the above figures indicate. The amount escaping through the silk bears no constant relation to the amount retained. Under these conditions the volumetric determination of the plankton by the use of the silk net as a test of the productiveness of water is not only incomplete but may be misleading.

For the examination of the plankton by the statistical method the silk affords a satisfactory basis only for the larger forms, such as the *Entomostraca* and the larger *Rotifera* and *Protozoa*. For the smaller and often very abundant planktonts, such as *Melosira*, *Peridinium*, *Dinobryon*, *Raphidium*, *Scenedesmus Euglena*, *Trachelomonas* and *Chlamydomonas*, the Hensen method is wholly inadequate. For example, from water in which these smaller forms were not extremely abundant the silk retained organisms to the number of 248,200 per cubic meter, while the catch of the Berkefeld filter indicated the presence of 767,556,000 planktonts in the same amount of water. Many of the organisms listed in the counting tables of Apstein may in reality escape in large numbers through the silk. Thus, of *Codonella* as many as *twenty-one* individuals may escape to *one* retained. The Hensen method must be supplemented by a more accurate system of collection if a complete census of the water world is to be taken.

From the œcological point of view the plankton lost by leakage through the silk s of prime importance, for it is composed very largely of minute algæ, which constitute a fundamental link in the cycle of aquatic life. Any attempt to unravel the complex interrelation of the constituents of the plankton or to correlate its ever-progressing changes with the factors of its environment must be based upon reliable data. Biological theory and aquaculture alike demand improvement in the plankton method.

The errors enumerated above are doubtless exaggerated by the situation with which we deal—waters rich in plankton and more or less turbid with silt. The tests, however, cover a considerable seasonal and local range of quantity and constituency, and have been made in both clear and turbid waters. The plankton, moreover, is composed very largely of the same genera as those found in the lakes in which Apstein and Zacharias have carried on their investigations, and over 50% of the species are identical. The desirability of experiments in other waters is at least suggested.

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SOUTHERN STAR-CLUSTERS.

The last of the great contributions of Benjamin Apthorp Gould to astronomy is contained in the large volume recently published under the title *Cordoba Photographs: photographic observations of star-clusters from impressions made at the Argentine National Observatory*. This work gives the measurements of the relative positions of nine thousand stars included in thirty-five clusters of the southern heavens and in the Pleiades and Præsepe.

In addition to the other large enterprises which constituted the regular work of the Argentine Observatory, over twelve hundred plates of southern clusters were secured (no important one being omitted) in the decade beginning in 1872, of which 281 have been measured and 177 are now computed. Inasmuch as the dry plate pro-

cess was not available until more than one half of the plates had been secured (in 1881), the serious character of the task of merely obtaining the photographs, with all the difficulties of the wet process, is sufficiently apparent. But this labor was small relative to that of the subsequent measurements and computations, which were carried out rigorously in all respects during the past fifteen years. As for the work at the micrometer it is stated that two assistants, alternately measuring and recording, could ordinarily measure from thirty to thirty-five stars a day.

It is, indeed, unfortunate that it was necessary that so long a time should elapse before the publication of the results, for it has delayed the recognition of Dr. Gould's position as the leading pioneer in the application of photography to astronomy of precision. It should be recalled that it was necessary for him to solve for himself, or with the coöperation of his friend, Lewis M. Rutherfurd, most of the difficulties of adjustment, measurement and computation, which have since engaged the attention of frequent congresses of the committee of the *Carte celeste*. It was as early as 1866 that Dr. Gould presented to the National Academy his memoir on the reduction of photographic observations, with the determination of the position of thirty-nine stars in the Pleiades, from measures by Rutherfurd on plates he had taken. It is much to be regretted that the publication of this memoir did not occur until twenty years later.

On going to Cordoba in 1870 Dr. Gould carried with him the photographic object-glass which Rutherfurd had so successfully used, but to his dismay he found it had been broken on the voyage. Thus the work was delayed three years, although a hundred plates were obtained with the mended objective, then replaced by a new one. Two exposures, of about eight minutes, were made upon each plate, a slight shift in right ascension intervening, so that defects on the plates could be distinguished from stars; then a third exposure gave either a trail or one point of the trail before the star left the photographic field of view, whereby the orientation of the plate could be determined. Of course, great difficulty was found in securing accurately circular images, especially as the modern plan of a large guiding telescope was not employed, but 'plates not satisfactory in this respect were summarily rejected without hesitation, no record being made of them, or numbers assigned.'

The measurements were carried out with two micrometers constructed by Rutherfurd and used by him in his early work. The coordinates measured were position-angle and distance, referred to some selected star as center. In some cases, of large clusters, several centers were employed, but the final positions are in all cases reduced to differences of right ascension and declination ($\Delta\alpha$ and $\Delta\delta$) from a single central star. As each plate contained some stars whose position had been determined with a meridian circle, the comparison of the catalogue and photographic coordinates furnished equations of condition from which corrections were applied to the latter. The accordance of the separate determinations of $\Delta\alpha$ and $\Delta\delta$ on different plates is highly satisfactory, and is not exceeded in recent measurements of clusters by other astronomers provided with telescopes and measuring micrometers of the latest design. Were such confirmation longer necessary, the reliability of the photographic method would be sufficiently established by the results of this volume.

Dr. Gould expresses the 'fear that trustworthy inferences from stellar photographs may not be expected in the present condition of science and the photographic art,' and hence does not attempt to utilize the photographs for photometric purposes, although approximate magnitudes are as-

signed and discordances noted. It may be, however, that the plates will later prove more useful than was anticipated in this direction. Certainly a comparison would be interesting with the Harvard Arequipa plates, on which Bailey has detected numerous variable stars, and the periods of some might thereby be accurately fixed.

A chapter of the work, in parallel Spanish and English, is devoted to each cluster, furnishing all the necessary data of measurement, the relative positions, and comparison with other, visual, measures where existent. Excellent charts are given of all the clusters. At the time of the lamented death of Dr. Gould, a year ago, one-half (pp. 248) of the volume had been printed, and the computations of the remainder were practically complete. But the unfinished portion of the manuscript has been carefully prepared after the original plan by Mr. G. E. Whitaker, to whom Dr. Gould makes acknowledgment for ten years of efficient service, under the general supervision of Dr. S. C. Chandler, and the whole volume may be fairly 'regarded as coming complete from the hand of its author.'

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CURRENT NOTES ON PHYSIOGRAPHY.

THE ASSAM EARTHQUAKE OF JUNE, 1897.

A report on the earthquake of June 12, 1897, in the Province of Assam has lately been published by the government of India in the form of a number of letters from local officers, English and native. The shocks occurred in the Khasi hills, famous as the district of the heaviest known rainfall; they are ascribed to faulting, entirely independent of volcanic action, of which there was no trace. Many ancient monolithic monuments were broken, or even torn out of the earth; their previously undisturbed condition being taken as evidence that no such earthquake had visited the region since their erection. In many villages the heavier houses were thrown down or badly injured, and had not most of the inhabitants been out of doors after a rainy morning the loss of life would have reached a greater number than is now reported, 1542. Among the hills much damage was done by landslides occasioned by the shocks; hillside paths were thus carried away, villages destroyed, and many people killed in the valley fields. In the plains to the south many deep cracks and crater-like pits were opened. One of the cracks was a mile long, two or three feet wide and 16 feet deep. Two persons lost their lives by being engulfed in such cracks. The pits average six feet in diameter and are spread around with sand that was thrown out by jets of water. In the Sylhet plains, traversed by numerous water courses, most of the villages are on the belt of higher floodplain close to the streams, and there much loss was caused by the slipping of the banks into the channels. Cholera and fever followed the earthquake, by reason of the disarrangement of water supply and drainage.

THE MOODUS NOISES.

A correspondent of the New York *Sun* states that the "famous and mysterious disturbances of the lower Connecticut valley, the 'Moodus noises,' are being heard again" after a silence of twelve years. The Indians knew of them before the coming of white men. For twenty years, up to 1729, the villagers thereabouts heard the noises almost continuously, 'shaking the houses and all there is in them.' They were again heard in 1852 and 1885. On the recent recurrence there was a sound like a clap of thunder, followed for some two hours by a roar like the echoes of a distant cataract. A day later there was a crashing sound like heavy muffled thunder, and a roar not unlike the wind in a tempest. The ground was shaken, causing houses to

tremble and crockery to rattle, 'as though in an earthquake.' In view of the compressed condition of the rocks in the Monson quarries, described by Niles some years ago, these indications of local disturbance are of much interest and deserve special study from local observers. The region is one of deformed crystalline rocks, but all the disturbances that can be dated geologically are of great antiquity. The nearest comparatively modern disturbances are in the Cretaceous and Tertiary strata of the islands south of New England.

PHYSIOGRAPHY OF MARYLAND.

THE first volume issued by the Maryland Geological Survey contains a sketch of the physiography of the State with hypsometric and geological maps. A good illustration of the natural use of the term 'plateau' as indicative of relative and not absolute altitude is found in its application to the Piedmont region, next inward from the coastal plain. Its highest part in Parrs ridge is under a thousand feet elevation. Sugarloaf mountain seems to be a well defined monadnock, surmounting the plateau. The major drainage of this region is in young valleys that show little relation to the underlying rocks; their streams give evidence of having been superposed through a cover of sedimentary strata which may have been the westward extension of the present costal plain, but "the broad fertile limestone valleys to which the present drainage has become partially adjusted are a striking feature of the area." We venture to express a hope that the fuller study of physiographic features promised for later volumes will not be addressed so much to 'those who may seek a home in Maryland' as to the teachers in the schools of the State, from whom the future citizens are to learn what the State really is.

TARR'S FIRST BOOK OF PHYSICAL GEOGRAPHY.

TARR'S Elementary Physical Geography has been found too advanced by many teachers; hence a smaller book has been prepared. In most respects it presents a good view of the subject, especially where the treatment turns toward the geological side; but in a number of instances it fails to 'start at the beginning and make everything thoroughly clear.' There is not a clear recognition of what is essential and what is unessential in a physical geography. The astronomical pages contain a number of purely astronomical matters, valuable as general information but here occupying space that could be better used by expanding the description and explanation of strictly geographical topics. The treatment of light is too physical and too advanced for a First Book. The chapter on the earth's crust is avowedly geological, so much so that the beginner cannot really appreciate it. For the student of geography it is better not to cross these geological bridges until they are encountered on his geographical journey. Under the lands many good lessons are taught, but process receives relatively more attention than form; and in spite of the importance which process deserves, this seems a mistake in a book that should be essentially geographical.

There are a number of careless inaccuracies of statement. It is said of hurricanes that "their birthplace is near the tropics" (p. 116). "The north magnetic pole lies to the southwest of the true North Pole" (p. 54). The redundant 'this' is too common; for example, 'in lieu of this inability to really conceive this' (p. 27). The treatment of the tides is not lucid; two sentences beginning with 'therefore' are followed by a third, whose conclusion will leave still in the dark those teachers who are puzzled about what they call 'that tide on the other side of the earth.' In these latter respects the book bears too evident marks of hasty preparation.

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CURRENT NOTES ON ANTHROPOLOGY.

THE PAPUANS AND MELANESIANS.

In a short article in *Globus* (Bd. 72, No. 9) Professor F. Müller sets in sharp contrast from the linguistic side the Papuans and Melanesians. The latter he considers to be Malayo-Polynesians, deeply tinged with Papuan blood, and speaking languages which are Malayan in grammar, but with a vocabulary containing a considerable residuum of Papuan roots. They have a decimal system, while the Papuans have only two numerals; the Melanesian dialects all have pronomial suffixes, which are wholly unknown in Papuan tongues; and other equally marked differences.

Like the negroes of Africa, the Papuans have a large number of widely distinct linguistic stocks; while it is well known that the Melanesians and Malayo-Polynesians are monoglottic. Physically the Melanesians are almost identical with the Papuans, but their tongues prove the deep influence of other blood. The purest examples of the Papuans are to be found in the interior of New Guinea, where they occupy a vast territory of which we know scarcely anything.

In this connection should be mentioned a paper on 'Observations on a Collection of Papuan Crania,' by Dr. George A. Dorsey, with notes on their decorative features by Professor Wm. H. Holmes, lately published by the Field Museum, Chicago. The measurements are most carefully done.

ETHNOGRAPHY AND HISTORIC SCIENCE IN AMERICA.

Under the above title Dr. F. Ratzel has an article in the *Deutsche Zeitschrift für Geschichtswissenschaft*, 1897, No. 3, appreciative of several recent works by American historical writers. He points out with force how the study of the aboriginal population of America has widened the range of historical views among us in the last quarter of a century. "Prescott described ancient Mexico as a curiosity which might have belonged to another planet. To-day the pre-Columbian culture of America pours light on the historic consciousness of Americans. Far beyond colonial history stretches the indefinite expanse of aboriginal history. This close relationship of history and ethnography forces the problems of the histories of races and peoples on the attention of every historical student."

Just how that relationship is to be understood and brought into the writing of history is a question which is not yet fully answered, as is easily evident from Dr. Ratzel's paper and the appendix to it by Dr. K. Lamprecht, one of the editors of the *Zeitschrift*. Enough, however, that it is recognized by such high authorities as one which can no longer be neglected.

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BOTANICAL NOTES.

ENUMERATION OF THE PLANTS OF EUROPE.

Seven years ago (1890) Dr. K. Richter brought out the first volume of a work entitled 'Plantæ Europææ,' which was intended to enumerate all the flowering plants growing spontaneously in Europe. The death of the author brought the undertaking to a standstill, and threatened to leave the work unfinished and fragmentary. Fortunately this calamity has been averted, and we are likely to see the work completed within a few years. Dr. M. Gürke, of the Berlin Botanical Museum, has recently issued the first fascicle of the second volume, and a second fascicle is promised within a few months.

The original plan of the work, which is practically unchanged by the new editor, included the systematic arrangement of all the European species under their proper orders and classes. The first description of

each species was to be carefully cited, and a full list of synonyms given. The original author adhered to the 'law of priority' with considerable rigidity, and therefore cited the dates of the accepted specific names and all synonyms. His initial date for the present system of nomenclature was that of the publication of the first edition of Linnæus's 'Species Plantarum,' viz.: 1753, and he discarded absolutely all earlier names. Dr. Gürke apparently does not so fully sanction the strict application of the law of priority, although he follows it in nearly all cases, his practice agreeing with that of the other Berlin botanists, who would except certain long-used names from the application of the law.

Volume I. included the Monocotyledons, which number 1839 species, 840 sub-species, and 122 hybrids. These are divided among 259 genera. The largest orders are the Gramineæ (751 species), Liliaceæ (342), Cyperaceæ (287), Orchidaceæ (170), and Iridaceæ (105).

The first fascicle of Volume II. includes a number of orders of apetalous plants, arranged in the Engler and Prantl sequence, viz.: Juglandaceæ (1 species), Myricaceæ (2), Salicaceæ (234), Betulaceæ (24), Fagaceæ (34), Ulmaceæ (7), Moraceæ (22), Loranthaceæ (4), Santalaceæ (26), Balanophoraceæ (1), Aristolochiaceæ (16), Rafflesiaceæ (1), Polygonaceæ (138), and Chenopodiaceæ (unfinished, 89). In many of the foregoing orders the numbers include many hybrids. This is especially true of the Willows, of which there are 48 distinct species and more than three times as many hybrids (178); of the Oaks there are 21 species and 11 hybrids, but here there are included under the 21 species no less than 52 sub-species.

THE DISEASES OF BERMUDA LILIES.

THE beautiful lilies which are annually grown in enormous quantities, to be used for decorative purposes during the Easter services, have become seriously affected by some obscure diseases which threaten to drive out their cultivation. For some time Mr. A. F. Woods, the Assistant Chief of the Division of Vegetable Physiology and Pathology, in Washington, has been studying these diseases, in the hope of finding their cause and cure. The diseased condition is characterized by the spotting and distortion of the leaves, flowers and bulb-scales, and the stunting of the plants. In severe cases the leaves, as they appear above the ground, are marked with small, yellowish-white shrunken spots, which finally dry out and collapse. Occasionally the disease appears to be somewhat local, the leaves on one side of the stem, or of particular whorls, alone being affected. It is estimated that from twenty to sixty per cent. of the entire hot-house crop of these lilies is annually destroyed by disease.

Many theories have been suggested as to the cause of the trouble, some attributing it to the growth of the bulbs upon worn-out soils, some to the weakening of the vitality of the plants by unscientific treatment, as premature removal of leaves, premature harvesting of the bulbs and want of care in the selection of bulbs for propagation. Others again suggest that bad treatment of the bulbs in the forcing house is the principal cause, while still others think that insects produce the trouble.

Mr. Woods finds, upon investigation, that, instead of one disease, we have to deal with several. The lilies are suffering from a complication of diseases. He summarizes his results as follows: "The work done shows that the disease is due to a combination of causes. In the first place, the bulbs have become weakened through improper selection and improper propagation, and this weakening is further increased by the attacks of mites and certain fungi and bacteria. Bulbs which have

been weakened in this way might regain their strength if the mites and fungi could be kept down; but those which are naturally weak cannot be made strong. During the time plants are being forced they may also be weakened by overwatering and consequent asphyxiation of the roots, or by allowing the roots to become too dry and then overwatering. The foliage of such plants may be free from spots and distortions, but usually the leaves are badly diseased. The spotting and distortion of the foliage is often due to the direct attacks of several genera and species of aphides and of the young of the bulb mite; to the injection of water into the young leaves in watering or syringing, and to the presence of water between the young leaves of plants having soft foliage. The injuries from the attacks of organisms are always more severe in the susceptible or naturally weakened bulbs."

No single course of treatment can be recommended to help this trouble. Careful selection of the bulbs, rotation of crops, avoidance of premature cutting of the stems or digging of the bulbs, the use of aërated soil, care in watering, the careful destruction of aphides and mites and the use of chemical fertilizers, instead of those derived from animal excrement, are recommended as likely to materially check the disease.

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University of Nebraska.

NOTES ON INORGANIC CHEMISTRY.

A recent number of the *Zeitschrift für anorganische Chemie* contains a review of the recent work on the genesis of petroleum and other natural hydrocarbons. Engler's hypothesis is that petroleum is formed by the distillation of animal fats at high pressure. Lobry de Bruyn has described a demonstration of this method of formation as a simple laboratory experiment. Heusler calls attention to the fact that Engler's distillate contains a considerable quantity of unsaturated hydrocarbons, which is not the case with petroleum. By treatment with aluminum chlorid these hydrocarbons are changed into a high-boiling lubricating oil; hence it is probable that petroleum formation took place in two stages, the first distillate being changed by metallic chlorids into petroleum. According to Ochsenius, petroleum was formed from plant and animal remains by heat and pressure under the influence of the salts derived from sea water. On the other hand, Moissan finds in his work on the metallic carbids, a confirmation of the theory first proposed by Mendeleef, that petroleum originates from the action of water on metallic carbids in the interior of the earth. Uranium carbid, for example, yields with water both solid and liquid hydrocarbons. These are, indeed, in part unsaturated, but at a higher temperature saturated hydrocarbons might be formed from them by the action of hydrogen, which is often evolved from carbids by water. Aluminum carbid and glucinum carbid, indeed, give with water pure methane (marsh gas). Viola believes that the asphalt and the petroleum of Castro de Volci, near Rome, in Eocene limestone and sandstone is of intratelluric origin, and has been distilled from great depths. The region shows decided evidence of volcanic phenomena. On the other hand, van Werweke holds that the petroleum of Pechelbronn, in Lower Alsace, has originated in Tertiary strata and has not come from below.

In a polemic article in the *Zeitschrift für angewandte Chemie*, D. Holde claims that the theory that petroleum has originated from animal remains should be known as the Engler-Höfer theory, Höfer having first proposed the theory in 1888 in his 'Das Erdöl und seine Verwandte,' and Engler having

by his experiments shown that petroleum can be thus formed.

FINALLY, Moissan, in the *Comptes Rendus*, states it as his opinion that according to its geological relations the formation of petroleum is to be ascribed to three different causes: (1) the decomposition of organic substances under the influence of pressure and heat; (2) the purely inorganic reaction between water and the metallic carbids; (3) volcanic processes. In many localities it is possible that all three of these factors may have contributed to the formation of petroleum.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

IN accordance with plans that we have already announced, the General Committee of the British Association for the Advancement of Science has decided that the next meeting will be at Bristol, under the presidency of Sir William Crookes.

SIR JOHN LUBBOCK has accepted the presidency of the International Congress of Zoology, which meets at Cambridge in August of next year. Sir William Flower was, as we regret to learn, compelled to resign the office, in view of the other pressing demands on his time and of medical advice.

PROFESSOR C. A. YOUNG, Professor A. A. Michelson and Professor E. S. Dana have been elected honorary members of the Philosophical Society of Cambridge University.

THE medals of the Royal Society will this year be awarded as follows: The Copley Medal to Professor Albert von Kölliker; a Royal Medal to Professor A. R. Forsyth; a Royal Medal to Sir Richard Strachey; the Davy Medal to J. H. Gladstone; and the Buchanan Medal to Sir John Simon.

SIR ROBERT BALL, President of the Royal Astronomical Society, has been presented with the Jubilee Medal.

DR. GEORGE H. HORN, the eminent entomologist, died at Philadelphia on November 25th. He was one of the Secretaries of the Philosophical Society and was formerly Corresponding Secretary of the Academy of Natural Sciences. He had been until recently professor in the University of Pennsylvania, though his connection with that institution was chiefly honorary. Dr. Horn was only fifty-eight years of age, and his death, following those of Cope and Allen, is a further severe loss to the city of Philadelphia and to science in America.

THE Rev. Dr. Samuel Houghton, from 1851 to 1881 professor of geology in Trinity College, Dublin, died on October 31st, aged seventy-six years. He was an original and versatile writer, having made many contributions not only to zoology and physiography, but also on medical subjects, including an elaborate work on the Principles of Animal Mechanics.

BY a private letter from Dr. J. Buttikofer we are informed that, although by the necessities of his recent appointment as Director of the Rotterdam Zoological Garden he has been obliged to leave Leyden Museum, where he has spent so many happy years, and which contains nearly all the zoological collections made by him in different countries of the world, he hopes, that as Leyden is distant but three-quarters of an hour from Rotterdam, to be able to do some ornithological work there. He is now engaged in finishing his report on the ornithological results of the Borneo Expedition, which he accompanied as zoologist, and of which some account was printed in SCIENCE of April 23, 1897.

PROFESSOR R. A. PHILIPPI, who, for forty-three years, has been Director of the National Museum in Santiago, Chile, having reached the age of ninety years, has resigned, and is succeeded by his son.

A MONUMENT to the eminent surgeon, the late Professor Billroth, was unveiled in Vienna on November 7th. Professor Gussenbaur, formerly assistant to Professor Billroth, made the principal address.

A BUST of Michael Faraday was unveiled at the Michael Faraday Board School, London, on November 15th. The bust, which is of white marble, was presented to the School by the managers of the Royal Institution of Great Britain, and is a copy of the original bust exe-

cuted by Matthew Noble. A brass tablet on the adjacent wall bears the following inscription: "Michael Faraday, natural philosopher, D.C.L., F.R.S., born at Newington, Surrey, September 22, 1791. He was a patient student, an eloquent expounder and a brilliant illustrator of the laws of nature. Fullerian Professor of Chemistry in the Royal Institution of Great Britain, 1833 to 1867. Faraday's noblest monument is his 'Experimental Researches in Electricity and Magnetism' from 1831 to 1851. He died at Hampton Court-green, August 25, 1867, and was interred in Highgate Cemetery."

Lieutenant Peary sailed on the Lucania on November 27th and will lecture in Edinburgh, after which he will try to find in Scotland a vessel of from 300 to 500 tons register for his next expedition to the north.

The steamship carrying the Belgian Antarctic Expedition has safely reached Rio Janeiro and left for Buenos Ayres on October 28th.

MM. Raoul and Mary have returned to Paris from a governmental mission to make researches into the indigenous plants of the Malay peninsula, with a view to determine whether any of them are of use for pharmaceutical or commercial purposes.

Professor Jaderin, of Stockholm, has, according to the New York *Evening Post*, proposed to the Academy of Science of that city that it arrange with the government for a preliminary expedition, with Russia's cooperation, to go to Spitzbergen next summer, and there prepare for the final measurement of a degree of latitude in 1899 and 1900, with a view of obtaining more exact knowledge of the earth's form.

Lieutenant Olufsen, who returned last spring from Central Asia, will next year fit out a new expedition to the Pamir regions in order to make geographical and ethnographical explorations in the northern part of the Wakhan valley. The expenses of the expedition, which will last two years and include two scientific students, will be paid from the Carlsberg fund of the Danish government.

The New York Park Board approved, on November 22d, the general plans of the zoological gardens in Bronx Park. There was no opposition to the plans at the public hearing.

The Meteorological Institute of Berlin celebrated the fiftieth anniversary of its foundation on October 14th. Dr. von Bezold, Director, made an address, in which, according to *Die Natur*, he stated that the Institute had in North Germany 188 stations of the first class and nearly 2,000 smaller stations.

A small marine laboratory, says *Nature*, was opened at Cullercoats on the 21st ult. by Principal Gurney, of the Durham College of Science, Newcastle-on-Tyne. The laboratory is the result of the public-spirited generosity of John Dent, Esq., the Vice-Chairman of the Committee. The laboratory was formally handed over to the Sea Fisheries Committee, to be worked in conjunction with the Durham College of Science, Mr. Meek being placed in charge of the scientific operations. A large company assembled, representing the Sea Fisheries Committee, the College of Science, the Natural History Society and the County Council.

The Subtropical Laboratory of the United States Department of Agriculture, at Eustis, has been discontinued, but work will be done at Miami, Florida. Mr. Walter T. Swingle and Mr. H. J. Webber, who had charge of the laboratory at Eustis, are at present in Washington.

The Smithsonian Institution has acquired the Hallett Phillips collection of Indian implements and antiquities from the Potomac valley.

Mr. P. A. B. Widener, of Philadelphia, has given his residence on Broad street for a branch of the Free Library. The value of his gift is said to be one million dollars.

The Annual Report of the British Board of Agriculture states that during the financial year 1896–7 the sum of £6,950 had been distributed to fourteen different educational institutions. The grant to the Durham College of Science was increased to £1,000, and that to Oxford University to £800. The Board recommends that a chair of agriculture and forestry be established at Cambridge University.

As the result of the preliminary examination made by Colonel Sir Thomas Holdich, the well-

known head of the Indian Survey Department, whose services were lent to the Ceylon government last winter by the government of India, a new survey is to be made of the island. The London *Times* states that the cadastral survey will be on a scale of 10 in. to the mile and the topographical on one of one in. to the mile. The triangulation and topographical survey will be completed in five or six years, but considerations of expense will cause the cadastral survey to be spread over a period of 25 years and to be restricted to crown lands and lands of doubtful ownership. The existing maps of Ceylon are full of errors, and for every grant made out of crown lands a special and expensive cadastral survey of the locality had to be executed.

THE Pirogof Museum of Surgery and Anatomy, in St. Petersburg, the plans for which we have already noted, was opened at the beginning of the present month. The building will serve not only as a museum, but also as the place of meeting of all the St. Petersburg medical societies. The $30,000 bequeathed for the purpose by Mme. Musin-Pushkin has been doubled by subscriptions, and some endowment remains after the cost of the building has been defrayed.

THE International Congress on the Protection of Birds, to which we have already called attention, opened at Aix-en-Provence on November 9th. The London *Times* states that the protection of insectivorous birds useful to agriculture was the chief matter discussed, and it was decided to forward to the governments of Europe, through the French Minister of Foreign Affairs, the resolutions that were formulated. Public educational bodies are also to be approached in order to obtain, if possible, the serious consideration of this important subject by schoolmasters and government school inspectors. Numerous French and Italian agricultural, horticultural and sporting societies were represented at the Congress, and delegates from the Selborne Society and the Society for the Protection of Birds were also present.

THE Civil Service Commission announces that on January 8, 1898, an examination will be held at Washington, D. C., and other places throughout the United States, for the position of Computer in the Nautical Almanac Office. Three vacancies are to be filled and only men are eligible.

THE University of Cambridge has after a long delay received $5,000 bequeathed by the late Dr. Joseph Gedge, who died in 1870 while with Sir Samuel Baker at Khartoum. The fund is for the establishment of a biennial prize for original research in physiology. It is open only to graduates of the University of more than five and less than seven years' standing.

DR. HUGHLINGS-JACKSON will give, on December 8th, the first lecture under the Jacksonian lectureship, established by the Neurological Society of London in his honor.

PROFESSOR OLIVER LODGE will deliver a course of six Christmas lectures (specially adapted to young people) on 'The Principles of the Electric Telegraph' at the Royal Institution, beginning on December 28th.

PROFESSOR ROYCE, of Harvard University, will deliver, at Cambridge, during the present year, six public lectures on 'Social Psychology.'

AT the meeting of the Botanical Club of the University of Chicago on November 23d Professor C. F. Millspaugh, Curator in Botany at the Field Columbian Museum, gave an account of his explorations in Yucatan, made on behalf of the Museum.

DR. H. C. PARKER gave, on November 29th, the first lecture in the course given annually by the New York Academy of Sciences. His subject was 'Recent Explorations in the Rocky Mountains of Canada,' including an account of the first ascent of Mount Lefroy, made by him last summer.

THE first of the Columbia University lectures in cooperation with the American Museum of Natural History will be given by Professor Kemp on Saturday, December 4th, and the two following Saturdays. The subject of his course is 'The Formation and Structures of the Crystalline Rocks.'

PROFESSOR GEORGE H. DARWIN, of Cambridge University, will lecture at Columbia University on the afternoon of December 10th,

nis subject being 'The History of the Earth and of the Moon.'

At the last meeting of the Zoological Society of London it was reported that the additions to the Society's menagerie during the months of August, September and October were 435 in number, amongst which special attention was called to a male and two females of a large deer from the Altai Mountains, probably referable to *Cervus eustephanus*, and apparently different in species from any deer previously exhibited in the Society's gardens, and also to a young male of the Caucasian wild goat (*Capra caucasica*). The total number of visitors to the Society's gardens during the months of August, September and October was stated to have been 278,253, representing an increase of 55,283, as compared with the number for the same period in 1896. From this source alone an increase of £1,344 19s. had been received during the same period.

Mr. L. O. Howard, of the Department of Agriculture, has been studying the work of the Massachusetts Gypsy Moth Commission in the neighborhood of Malden and Medford, with a view to the preparation of a special bulletin of the Division of Entomology, describing the process of extermination employed. Agent O. A. Hubbard, of the Committee, has been temporarily detached and detailed by the State Board of Agriculture to study the region infested by the brown-tail moth and warn property holders of the danger and the need of using active measures for its destruction.

Mr. H. A. Morgan gives, in Bulletin No. 48 of the Louisiana Agricultural Experiment Station, some interesting observations on *Trissolcus murgantiæ*, an important parasite in the eggs of the harlequin cabbage-bug in Louisiana. He finds that eggs of the cabbage-bug pierced by the parasite on July 20th produced adult parasites on July 30th, showing the entire life cycle of the parasite to be ten days. In August 60% of the eggs of the harlequin bug contained these parasites. Experiments are being conducted with a view to the introduction of this parasite into Kentucky and Ohio.

Since the *Medical News* was removed to New York, giving that city three of the four leading medical weeklies of America, the scientific and medical men of Philadelphia have felt the need of a good weekly journal. This will be filled after the first of January by the publication of the *Philadelphia Medical Journal*, to be edited by Dr. George M. Gould, and published by the Philadelphia Publishing Company, with a capital of $30,000, which we understand has been fully subscribed. The trustees consist of the leading physicians and medical professors of Philadelphia, the different schools being duly represented.

L'Intermediare des biologistes, the plans for which we announced sometime since, has now begun publication, the first number being dated November 5th. It will be published twice a month, and the present number contains twenty-four pages. In addition to an introduction we find a short article by M. Marey, advocating the plan brought forward by him at the recent meeting of the French Association in favor of an international control of physiological instruments; forty-six questions to which replies are requested; the contents of the special journals of zoology, botany, physiology and psychology and short descriptions of three instruments. The journal throughout shows the psychological interests of Professor Binet and his associates in the editorship. In the introduction it is stated that a complete bibliography of the literature, so far as it is contained in other journals, will be given, but we think that the magnitude of this undertaking is scarcely realized. The series of questions is a feature that has, perhaps, not been undertaken in a scientific journal and may prove of value. Among the 34 'collaborateurs' there are two Americans, Professors Minot and Baldwin, and one Englishman, Dr. Sherrington. The price of subscription for America is 12 fr., to be sent to the publishers, Schleicher Frères, Paris.

The last issue of *Industries and Iron* states that it is the first newspaper produced in Europe by the aid of the Lanston Monotype type-casting and composing machine. The whole of the matter in the body of the paper has been printed from types composed and justified into lines on the keyboard machine,

and the jacquard or perforated paper so produced has enabled the casting and setting into lines and galleys of the finished matter presented.

THE new rules of the United States Patent Office, which go into effect on January 1st, contain some important alterations. Hereafter no invention can be patented if it has been described two years or more before the filing of the application, or more than seven months after a foreign patent has been allowed. On the other hand, the duration of an American patent is not limited by its expiration in other countries.

THE South African Republic has passed an amendment to their patent laws which is an ingenious method of collecting revenue. Only a small fee is required for granting the patent, but for each period for which it is extended an additional payment is required. Thus, for example, from eleven years to the limit of fourteen years $1,000 is required.

A DEPUTATION from the Manchester Chamber of Commerce was received by the President of the British Board of Trade on November 17th, the object of which was to call attention to the fact that patent rights were granted to foreign subjects in Great Britain for inventions which cannot be patented in their own. It was stated that very serious injury was inflicted upon British industrial interests in consequence of this inequality, and it was asked that the Patents Act of 1883 should be amended so as to remove the inequality, and that the duration of any British patent granted to a foreigner should not exceed the term of his patent in his own country. The deputation also desired that, as complementary to this amendment, the British representative at the forthcoming congress of the international convention for the protection of industrial property, to be held in Brussels next month, should be instructed to support the propositions for the alteration of the rules of the convention, which would permit the amending legislation in question.

MR. CHARLES T. RITCHIE, President of the British Board of Trade, in a speech before the Croydon Chamber of Commerce on November 23d, is reported to have said that Great Britain had more to fear from the United States than from Germany in industrial competition. "The facts are serious," he continued, "and call upon us for the exercise of all our powers to enable us to maintain our position in the commercial world. There is no doubt the United States are executing orders which ought to be executed here. As we all know, an American firm obtained the contract for the Central Underground Railway (of London), as its bid was lower than those of the English concerns and it could deliver the supplies three months ahead of the British tenders. Many important Continental orders have gone to America. The same is to be said of Egypt and Japan, where the Americans are doing work that Englishmen should have done."

THE conductors of the London *Academy* have devised a successful plan of advertisement in selecting a British Academy of Letters and its forty 'Immortals.' With the exception of two or three superannuated giants and half-a-dozen contemporary men of letters, the list seems to be chiefly remarkable as an exhibition of the mediocrity of British literature. The only excuse for mentioning the proposed Academy in this place, however, is to call attention to the fact that it does not contain the name of a single man of science. It is probably true that there is now in Great Britain no man of science who is also a man of letters as Huxley was; still if philologists such as Professor Skeat and Professor Jebb, and historians such as Bishop Stubbs and the Rev. Dr. Gasquet, are included among the forty Olympians there seems to be no reason why men of science such as Lord Kelvin, Professor Foster, Professor Sidgwick and Mr. Galton should be excluded.

THE fiftieth anniversary of Professor Virchow's joining the teaching staff of Berlin University was celebrated on November 6th. The *Lancet* states that in 1847 Professor Virchow, who had previously belonged to the Army Medical Staff, was appointed a *privat-docent* at the University, but political considerations were all-powerful after the revolutionary troubles of 1848, and as he was known to hold democratic opinions he was under the necessity of leaving Berlin and accepting a professorship

at Würzburg, in Bavaria. His exile, however, did not last very long, for as far back as 1856 he was elected professor of pathological anatomy in Berlin, an appointment which he still retains. On account of Professor Virchow's infirm state of health the jubilee proceedings were of a more private character than would have otherwise been the case, being limited to addresses of congratulation delivered by the rector of the University and the dean and professor of the medical faculty. The rector, Professor Schmoller, referred to Professor Virchow's achievements not only as a physician and a pathologist, but also as a biologist and as a savant whose methods of research had influenced every branch of human knowledge. The dean, Professor Huebner, eulogized him as a *privat-docent* of an altogether superior order—a teacher not only of students, but also of professors. At an age when young men were, as a rule, far from having mastered what had been already discovered he succeeded in solving the most difficult problems of biology. Professor Virchow in his reply pointed out that he was happy in the knowledge that a body of men now existed in German universities strong enough not only to maintain the principles laid down by him, but also to continue the work in the light of modern developments. He felt that his work was done and that he was now entitled to retire from his academical position, especially after having succeeded in obtaining a promise from the government that a new and modern pathological institute and museum would be constructed after his designs. A great number of telegrams, letters and other marks of Professor Virchow's great popularity were received by him during the day.

The National Photographic Record Association of Great Britain, to which we have already called attention, have sent out a circular in which they state that well-wishers of the Association, the subscription fee for which has been fixed at a small sum with the object of enlisting wide and general support. Photographers and others can assist by contributing photographs (which must comply with the regulations set forth in the by-laws), or by acting as honorary agents and collectors in their respective localities. The Council look for generous support from photographic and camera clubs throughout the country, as well as from individual amateur photographers, who must now form a complete network of workers over the whole British Islands. The Council also appeal to the large and important professional class of photographers for copies of rare and especially interesting pictures taken by them. From scientists, antiquarians and others assistance is desired in searching among the rich stores of old and neglected negatives taken in past years which are known to exist, the identification of which gets more difficult as time passes, and also by using influence with their amateur photographic friends in inducing them to seize opportunities of recording passing events. Others may render valuable help by purchasing pictures from dealers and presenting them to the national collection, thus rescuing records which might otherwise be lost. In the course of the present jubilee year there must have been many thousands of photographs taken of local celebrations, which, if brought together, would form a most valuable chapter of national history, and it may be remarked in passing that it should be born in mind that a single picture of historical interest will always be acceptable. In conclusion, the Council wish it to be understood that there is no thought of competing or clashing with the excellent work of the same kind which is being so well done by the several county photographic survey associations, such as those of Warwickshire, Worcestershire, Yorkshire, Cheshire, etc., in their commendable efforts to form local collections, but rather a hope is entertained that such useful work may be encouraged by loans being made from time to time from the national collection, before being deposited in the British Museum, of interesting pictures from other localities for the purposes of exhibition.

The Botanical Gazette states that the Seaboard Air Line Railroad, which extends from Portsmouth, Va., to Atlanta, Ga., has inaugurated a novel system of instruction of the communities along its territory. During the present season it has been holding one-day farmers' institutes, all illustrative material and appliances and the force of instructors being transported from place to place in a train of cars especially fitted up

for the work. It is proposed to establish experimental farms every ten miles along the whole line, twenty-eight having already been organized.

AT the first meeting of the present season of the Royal Geographical Society, the President, Sir Clements Markham, made an address in which he says, according to the report in the London *Times*, that the recess had been signalized by the publication of two important geographical works—the admirable monograph on British Central Africa, by Sir Harry Johnston, with its fascinating chapters on the scenery and the physical aspects of that region; and the 'First Crossing of Spitzbergen,' by Sir Martin Conway; while they had themselves brought out Sir William Macgregor's interesting paper on 'British New Guinea' in the form of a small volume. There had also been much activity in the field. In Africa, Mr. Cavendish, who only completed his twenty-first year last May, had made a very remarkable journey from Berbera, across the Somali country, to the river Jub, and then inland to Lake Rudolf. He shared with the late Captain Bòttego the honor of being the first to explore the western shores of that lake. With regard to Siam they might expect another communication from Mr. H. Warington Smyth. In Central Asia the labors of Dr. Sven Hedin, which had been continuous during several years, were of great geographical importance. Not less important and quite as interesting were the explorations now being carried on in the Afridi country by their gallant associate, Sir William Lockhart. They must all feel enthusiastic on reading of the skill and ability with which his old friend was conducting a most difficult campaign, and of the brilliant dash and devotion of the Gordon Highlanders and other troops who were serving under him. As Fellows of that Society they rejoiced that the success of their arms also entailed successes for the cause of geography. Their friend and associate, Mr. Fitzgerald, was also returning from his arduous examination of Aconcagua, which was believed to be the loftiest peak in the Chilian Andes. There would, so far as he was aware, be no new work from the Antarctic regions during the ensuing season, unless, as he hoped, the Belgian expedition, commanded by M. de Gerlache, should be able to send news of any discovery before the close of the season. But the efforts of their Council to procure the dispatch of a British Antarctic expedition had never ceased. Meanwhile, Sir George Newnes had supplied funds for a Norwegian enterprise, to be conducted by Herr Borchgrevink. In the Arctic regions there had been much activity this summer, and it was reported that it was the most open season that had been known for many years. They now had to welcome Mr. Jackson, Mr. Armitage, and the other members of the expedition on their safe return, and to congratulate Mr. Harmsworth on the valuable results of his patriotic munificence. Following the President's address, Mr. Frederick G. Jackson lectured on the scientific results of the Jackson-Harmsworth expedition.

AT the opening meeting of the Linnæan Society, London, an interesting collection of zoological and botanical exhibits collected by the Jackson-Harmsworth expedition was shown by Mr. F. G. Jackson, the leader, and Mr. Fisher, the botanist of the expedition, the former also exhibiting upon a screen a number of photographs of animals and birds which inhabit the Arctic regions. Some lantern slides of marsh birds and their nests from photographs recently taken in Spain and Holland were shown by Mr. Reginald Lodge. Following a discussion upon these exhibits, Sir John Lubbock, M. P., read a paper on 'The Attraction of Flowers for Insects,' in reply to three memoirs recently published by Professor Plateau. According to the report in the London *Times* Sir John Lubbock explained that his view was, like that of Sprengel and Darwin, that we owe to insects the beauty of our gardens and the sweetness of our fields. To them, he said, flowers were entitled for their scent and color. Not only had the present shapes and outlines, brilliant colors, the sweet scent and the honey of flowers been gradually developed through the unconscious selection exercised by insects, but this applied even to minor points, such as the arrangement of lines and the different shades of color.

UNIVERSITY AND EDUCATIONAL NEWS.

Mr. Thomas McKean, of Philadelphia, has given $100,000 to the University of Pennsylvania for a building for the law school.

Mr. John D. Rockfeller, of New York, has given an additional $10,000 towards the erection of a hall at Mt. Holyoke College, and if the conditional gift of Dr. Pearson is included the sum of $175,000 has now been collected for the endowment fund.

Brown University has received $5,000 by the will of the late Eustace Fitz, of Chelsea, Mass.

Ferry Hall, one of the buildings of the State Agricultural College, Pullman, Washington, has been destroyed by fire, causing a loss of about $40,000.

The registration in Harvard College is this year 1,814, an increase of 6.2 per cent. over last year. The number of students in the Lawrence Scientific School is 407, an increase of 9.5 per cent.

It is stated that the decree excluding foreign students from the medical classes of the Faculty of Medicine of Paris will shortly be withdrawn.

Dr. Th. Curtius, professor of chemistry at Bonn, has been called to Heidelberg as successor to Victor Meyer.

DISCUSSION AND CORRESPONDENCE.

HOTEL ACCOMMODATIONS AT ITHACA FOR MEMBERS OF THE SCIENTIFIC SOCIETIES.

Since the publication of the official announcement of the Society the Ithaca Hotel has been sold, and the new owners have closed it for extensive repairs. That hotel will not be open for guests nor for the annual dinner. The other hotels will be open. The Clinton House can accommodate from 50 to 75 and the new Hollister from 30 to 40 guests.

The annual dinner announced for the Ithaca Hotel will be held at the dining rooms in Cascadilla Place, these being the largest and pleasantest dining rooms upon the University campus in Ithaca. The time and cost will be as in the announcement.

A limited number of ladies can secure rooms and board at Sage College. Rates can be had upon application to the Local Secretary. There are numerous pleasant rooms in the near neighborhood of Cascadilla Place, which, with board in the house or at Cascadilla Place, would cost from 75 cts. to $1.50 per day. The Local Secretary will secure rooms for any who apply to him.

S. H. Gage, *Chairman*,
W. W. Rowlee, *Secretary*,
of the Local Committee.

Ithaca, N. Y.,
November 30, 1897.

THE CAIRN ON THE ENCHANTED MESA.

To the Editor of Science: I have just read Professor Libbey's letter, in your issue of the 26th instant, in which he intimates that the lichen-covered cairn on the summit of the Enchanted Mesa was erected by himself. It now only remains for Professor Libbey to say that the ancient potsherds scattered through the talus, the artifacts found on the summit, the remains of the ancient ladder-trail and all the other evidences of the former occupancy of the summit of the mesa are the result of his own ingenuity. The last word will then have been said.

F. W. Hodge.

Bureau of American Ethnology,
Washington, November 29, 1897.

[As Professor Libbey states that the cairn was erected by him Mr. Hodge should certainly correct his mistake. Whether or not the Mesa was formerly inhabited is another question.

Ed. Science.

A POSSIBLE SOLUTION OF THE SEALING PROBLEM.

To the Editor of Science: In the article in Science last week on the Sealing Conference, and in the innumerable articles that have been published since the question became prominent, I have not noticed any mention of what seems to an outsider the most natural solution. It is absurd for the United States to claim that it has any right to control the action of Canada on the high seas on the ground of humanity to animals or of commercial interests. Great

Britain would have just as much right to protest against the extermination, by the United States, of the buffalo and the beaver.

It has been suggested that the seals might be exterminated, but this would be sawing off the branch with the man on it, unless the proposers of this plan mean by it what I wish to suggest. This is that so many seals be killed on the Islands that there would not be enough left in the seas to make pelagic sealing profitable. It would seem possible to keep a small herd on the Islands and the killing of the small number would be very profitable, as the price of sealskins would doubtless rise. It looks to me as if we had the trump card in our hands and could offer Great Britain almost any conditions on pelagic sealing that we like.

P. C. H.

NEW YORK, November 27, 1897.

OBSERVATIONS ON THE PHYSIOGRAPHY OF WESTERN MASSACHUSETTS.

THE following notes on the character and elevation of the Cretaceous peneplain in western Massachussetts were made during a trip in the Berkshire region in the spring of 1897. The area covered lies between the Housatonic and Connecticut lowlands and south of the Boston and Albany Railroad.

From map-study alone the tendency is to locate the peneplain by the broadest tracts of level country to be found upon the map and to call what lies above monadnocks. It was found, however, that this estimate placed the peneplain altogether too low. The broad spaces proved on observation to be broad, shallow tracts of etched-out country, and most of what had been supposed from map-study to be monadnocks fell into a very good level skyline. The region contains but few monadnocks, and these of small size, their size and number decreasing from north to south.

In the township of Hinsdale the peneplain lies at a height of 2,050 to 2,100 feet; at Washington Centre it falls to 2,000 feet; and seven miles in a south-southeasterly direction, near Becket Centre, it is but 1,850 feet in height. Between Sandisfield Centre and New Marlborough, about seventeen miles due south of Washington, the height of the peneplain decreases to 1,750 feet; at Tolland Centre its elevation is about 1,550 feet; and at Blandford Centre, about eight miles to the northeast, the same. By comparison of these points the following conclusions were reached:

(1) The peneplain dips from about north-northwest to south-southeast.

(2) Its fall in twenty-five miles is about 550 feet, a rate of twenty-two feet to the mile.

An apparent consequence of this slope of the peneplain is the prevailingly south-southeast courses of the streams, great and small, throughout the area. Along the escarpments where the upland falls off into the Housatonic lowland or into the Connecticut lowland the streams naturally follow the steeper gradient and have cut east and west courses some distance back into the upland, though even these streams in their upper courses conform more and more to the habit of the other streams. The long axes of the lakes and ponds also lie prevailingly northwest and southeast, and the majority of the long, straight stretches of road follow the same direction.

ROLAND B. DIXON,
CHARLES D. DREW.

SCIENTIFIC LITERATURE.

The Dawn of Astronomy, a study of the temple-worship and mythology of the ancient Egyptians. By J. NORMAN LOCKYER. New York and London, The Macmillan Co. First edition, 1894; second edition, 1897. Octavo, pp. 432. Illustrated. Price, $3.

Sir Norman Lockyer first gave his attention to the questions treated in this book in the year 1890 and they are stated in his preface somewhat as follows: It is a matter of common knowledge that many of the churches of England are so constructed that their eastern windows face the point of sunrise on the day of the patron saint. For example, the churches dedicated to St. John the Baptist face nearly northeast. The question arises whether the Egyptian temples have a similar orientation to the sun or to some star. This can be completely determined by accurate surveys of the temple sites; by an investigation of the inscriptions, etc.; by a study of the mythology and history of the people; by the calcu-

lation of tables of the rising and setting of the stars for a period extending backward some 9,000 years, and by a painstaking discussion of the data so amassed. A part of the work described has been done by Professor Lockyer, and the results reached since the year 1890 (when some of them were first announced by him) are set forth in this volume. During visits to Egypt he executed surveys of a few temple-sites and the necessary calculations have since been made.

The French Scientific Commission which accompanied Napoleon in his Egyptian campaign, and the Commission sent by the Prussian government in 1844, have published a vast amount of accurate information regarding the sites, etc., of Egyptian monuments which bears directly on the problem in hand.

Professor Lockyer's general conclusion is that certain of the Egyptian temples are, in fact, oriented by the stars as well as others by the sun. The same conclusion was reached quite independently in 1885 by Professor Nissen, of Germany, though his work was unknown to Lockyer at the time. Such is the general problem. The particular developments are given in a stout octavo volume first printed in 1893 and now reprinted without change, I believe.

The course of the argument in detail is somewhat as follows: Egyptian chronology, the succession of kings, must be regarded as comparatively well known, considering the great difficulties of the subject. Making all allowances for errors, the dates of many temples are well fixed by their inscriptions. The mythology of Egypt has likewise been studied with remarkable success, and this mythology has, in general, astronomical relations, as indeed is the case in many countries. In Egypt, as in other lands, there were gods related to the sun, the moon, and a special goddess for the stars. Their zodiac is represented by existing sculptures whose figures have at once a mythologic and an astronomic meaning. The priests made sacrifices at dawn and at other seasons related to the sun's diurnal and annual courses. Inscriptions at Thebes show that the risings of stars were observed throughout the entire year; and the *heliacal* rising of Sirius was connected with the floods of the Nile. In Egypt, as in India, the pantheon was mainly composed of solar deities, but some of the personages had intimate relations to stars and planets.

During the course of the year the sun rises and sets at various points of the horizon of any place. It rises farther to the north during the summer, farther to the south during the winter season. A star, however, rises at (sensibly) the same point of the horizon for a century or so, though the stars, too, have a slow motion due to precession, which will, finally, produce great alterations in their points of rising. The rising of a star with the sun at a certain period of the year—its *heliacal* rising—would be a marked phenomenon, especially if the date coincided with a critical time of the agricultural cycle. Any recurring event of this nature may serve to mark off dates—the heliacal rising of a star; the rising (or setting) of the sun at the equinoxes or solstices; or the rising or setting of a fixed star. The orientation of a temple might well preserve the direction in which the semi-sacred appearance was visible and there is no doubt that many structures have been so oriented. From ancient times worshippers have chosen to face in a fixed direction during their devotion or sacrifice.

The existence of solar temples in many parts of the world is established beyond a doubt. Some Egyptian temples are oriented to the sun at its rising at the solstices (Karnak, Thebes, etc.); some to its rising at the equinoxes (Memphis, Gizeh, etc.) according to Professor Lockyer. The orientation is changed from solstitial to equinoctial in these cases, and Lockyer points out that so fundamental a variation in astronomical thought strongly suggests a change in the ruling race and religion. The rise of the Nile is related to the season of the summer solstice; that of the Tigris and Euphrates to the season of the spring equinox. Have we here, the author asks, an indication of two races which expressed ideas in the monuments? The suggestion is ingenious. So far as I know, it has not been very hospitably received by experts. It is interesting to note that the temple of the sun at Peking is oriented to the winter solstice; Stonehenge to the solstice of summer; the temple of Solomon similarly to the temple of Isis at the Pyramids;

St. Peter's at Rome so that the sun's rays at the vernal equinox illuminate the high altar, etc., according to Professor Lockyer. The inscriptions of some of the Egyptian temples prove, if proof is necessary, the intention of their builders. Speaking of a pair of obelisks at Karnak an inscription reads, "They are seen an endless number of miles away; it is a flood of shining splendor when the sun shines between the two;" and again, "The sun's disc shines between them as when it rises from the horizon of heaven."

It is to be noticed that if the orientations of the builders were exact, and if the measures and directions determined at the present day are accurate, it is a mere matter of calculation to fix the astronomical date at which a temple was constructed, provided their original intention is known to us. The dates of several of the solar temples can be assigned with considerable accuracy in this manner. If we should find, as in fact we do find, says Professor Lockyer, that the builders of set purpose have slightly altered the direction of the axis of a temple during its construction, this will be a sign to indicate that the celestial body related to the temple has changed its direction during the period, perhaps several centuries, of construction. It is upon facts of this kind that Lockyer bases his proof that some of the temples are related, not to the sun, but to stars. This is the key-note of the book. The change of direction of the axis is not to be explained by a change in the sun's direction, but demands another interpretation. The situations and arrangements of the principal stars were well known to the inhabitants of the Nile Valley. We have seen that many of the Egyptian temples are oriented to solar positions. There are many temples that cannot by any possibility be so oriented. They are built so that no ray of sunlight can pass along their axes at any period of the year. The question arises, are these temples oriented to stars? or, again, are they oriented at all? Are their directions assigned by chance? The topographic conditions of the sites seem to show, in a number of cases, that their builders had a set purpose in facing them as they are faced. If the direction of their walls had no significance they would, it seems, have been differently placed. The latter half of the volume under review is devoted to these questions, namely: Were such temples oriented to a star? to what star? and at what epoch were these monuments constructed?

Every detail of construction goes to show that this group of (stellar) temples was built to receive a horizontal ray of light along the axis just as the solar temples were. A striking fact in this connection is that the (stellar) temples frequently exhibit a change of direction of the principal axis, such as calculation shows would be necessary to allow for changes in the direction of stellar beams every few centuries. A solar temple does not require such changes of axial direction. "Once a solar temple, a solar temple for thousands of years; once a star temple, only *that* star temple for something like three hundred years." If after some three centuries the stellar light no longer penetrated the temple a change of direction of the axis would be required. It is just such changes of direction that have been found.

The foregoing summary is believed to represent with fairness the *method* adopted by Professor Lockyer, and to indicate, at least, his main conclusion, namely, that many of the Egyptian temples have stellar relations and were oriented so that the horizontal rays of Capella, *Gamma* Draconis, etc., etc., might fall along their axes at the time the buildings were constructed. The latter half of the book is given to a detailed proof of the stellar relations of the temples, and it deals not only with architectural measurements and astronomical computations, but with recondite questions of mythology, history and ethnology. To the writer of this review it seems that the chief merit of the book is to have called attention to a most important province of the history of the growth of astronomic notions (and thus of religious ideas) and to have set forth in plain and popular form the obvious method of research which must be resorted to. It seems that further research is called for. It may lead to certain and definite results. The present volume can hardly be said to have proved all its points. To judge it completely one should be historian, ethnologist and astronomer in one; but one need be no more than a

humble logician to point out various flaws in the argument.

I believe the Egyptologists do not accept the Zodiac of Denderah and the inferences of Biot as unreservedly as Professor Lockyer. The ethnologists will, I understand, raise many objections to Professor Lockyer's hypothesis of a change of race and religion. Mythologists will surely rebel against his treatment and interpretation of myths. Astronomers will point out how *many* stars there are and how few temples, so that it may not be so very difficult, given several hundred years of leeway, to choose a star to fit a temple. Plain people will ask how it is that a temple is, so to say, dedicated to one star and oriented by another. Sirius was the *star* related to Isis, Mut and Hathor. But the temples of these deities are not invariably oriented by Sirius. *Gamma* Draconis is a rather faint star. Why were not brighter ones selected?

After raising these objections and a crowd of others that might be brought forward, it remains that Professor Lockyer's book is a contribution of high value and merit. A question of importance has been plainly put. The method of solving it has been described in popular language. The data now available has been brought to the notice of everyone. If Professor Lockyer has done little more than this, and if his principal conclusions still call for further confirmation, he deserves the thanks of all concerned in these questions—and who is not?

EDWARD S. HOLDEN.

Song Birds and Water Fowl. By H. E. PARKHURST. New York, Scribners. October, 1897. Illustrated by Louis Agassiz Fuertes. 12mo, pp. 286. Price, $1.50.

If there is any truth in the law of supply and demand, the present flood of popular bird literature must be taken as evidence of an extraordinary if not unprecedented interest in the subject of birds and nature. It is a healthful interest and one which awakens and develops some of the better elements in our natures which are apt to lie dormant.

Mr. Parkhurst's 'Song Birds and Water Fowl' is not intended as an aid to the identification of specimens, but belongs rather to the class of popular nature studies. A fair idea of the contents may be had from the chapter headings, which are as follows: A Boquet of Song Birds; Water Fowl; A Bird's-Eye View; Mistress Cuckoo; Sea Swallows; Bird's Nests; At the Water's Edge; Lake George; A Colony of Herons; Earliest Signs of Spring.

The book is illustrated by eighteen admirable full-page drawings by Fuertes.

C. H. M.

Birdcraft, a Field Book of Two Hundred Song, Game, and Water Birds. By MABEL OSGOOD WRIGHT. New York, The Macmillan Co. November, 1897. With 80 full-page plates by Louis Agassiz Fuertes. 8mo, pp. 317. Price, $2.50.

The second edition of Mrs. Wright's 'Birdcraft' is a pleasant surprise. The cheap chromos of the first edition are replaced by a colored frontispiece and eighty full-page half-tone plates from original drawings by Fuertes, the powerful young bird artist who has so suddenly sprung into fame. Most of these drawings have recently appeared in 'Citizen Bird,' by the same author and Dr. Elliott Coues (noticed in SCIENCE of November 5, 1897, p. 706).

Since the text of the second edition of 'Birdcraft' is printed in the main from the same electrotype plates as the first, it is only necessary to refer to the review of the former (SCIENCE, June 7, 1895, p. 635), with the additional statement that the principal errors there mentioned have been corrected. The book in its present form is attractive, interesting and helpful and should be in the library of every lover of birds.

C. H. M.

Magic Stage Illusions and Scientific Diversions, Including Trick Photography. Compiled and edited by ALBERT A. HOPKINS, with an introduction by HENRY RIDGELY EVANS. New York, Munn & Co. 1897. With four hundred illustrations. Large 8vo. Pp. 556. Price, $2.50.

The associations of the term magic are hardly suggestive of scientific processes or principles; they are more apt to call up an atmosphere of mystery and secret knowledge, a world of the

unexpected and the unfathomable. But the magic of to-day bears quite as conspicuously its many of the applied arts and crafts the marks of the laboratory and the research room. Nineteenth century magic reflects the evolution of nineteenth century science and can look back with an air of condescending amusement or curious interest upon its old-time antecedents, much as the modern chemist reads the annals of alchemy or the superbly equipped astronomer contemplates the vagaries of the mediæval astrologer.

There is, indeed, much to interest the student of science in the elaborate performances of the prestidigitateur and the illusionist; and the interest is two-sided, physical and psychological. The physical interest centers in the description of the true *modus operandi* of the tasks and the accompanying paraphernalia; the psychological interest in the method of arousing false perceptions and inferences and producing the conviction that the impossible has happened. The student of the psychology of deception takes his place with the audience and observes how readily their attention is diverted at critical moments, how easily they overlook the apparently insignificant but really essential settings of the trick, how the bewilderment increases and the critical faculties lapse as one bit of sleight-of-hand succeeds another. The student of the curious and intricate applications of science must be stationed behind the scenes and observe at times how simple a contrivance evades detection, or, again, how an elaborate combination of mechanical principles is ingeniously applied to produce a startling effect. The main lesson which the psychologist takes away is the importance of the attitude in creating belief, the dominance of cleverly suggested expectation in our sense experience, the readiness with which we substitute inference for observation and go away convinced and deceived. The physicist or the mechanician is quite certain to be impressed with manifold possibilities of mystification which the rapid increase of science brings in its train.

This ably compiled volume will appeal to both types of readers as well as to the more popular interest in mysteries and the processes of deception. It is wide in scope, treating of conjuring tricks of all varieties; of jugglers and fire-eaters; of puppets and shadow dances; of ventriloquism and second sight; of the application of science to stage effects and cycloramas and fireworks; of automatic and scientific toys; of the kinetoscope and the vitascope, and the varied applications of photography; and in addition to all this some interesting information upon the conjuring tricks and performances of olden times. The tone of the descriptions is clear and the volume is well adapted to satisfy the needs of the somewhat heterogeneous class of readers who are likely to consult it. Moreover, the book is distinctly modern, and avoids both the unnecessarily popular and frequently irrelevant style of much of this kind of literature. It comes as nearly within the pale of science as any book with this kind of a purpose can be expected to reach. A valuable bibliography and index add much to its usefulness.

JOSEPH JASTROW.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES—SECTION OF BIOLOGY—NOVEMBER 8, 1897.

THE meeting was called to order by Professor Wilson, the Chairman. Twenty-two persons present. After reading the minutes of the previous meeting, the following program was presented:

Mr. Matthews reported on analyses of spermatozoa in Kossel's laboratory, Marburg. Sperm of *Arbacia*, herring, pig and bull were examined. Herring sperm heads were separated from the tails by Meischer's method, and made free from albumen. They consisted of protamin nucleate, having the formula $C_{40}H_{54}N_{14}P_4O_{27}$, $C_{30}H_{57}N_{17}O_6$. The nucleinic acid appeared identical with that of salmon sperm (Meischer), although the protamin differed from salmon protamin, as shown by Kossel. The sperm tails consisted chiefly of a combination of lecithin, cholesterin and albumen, similar to, but not identical with, similar constituents of salmon sperm tail. The tails contained no nuclein. The heads contained no lecithin nor cholesterin. *Arbacia* sperm contained nucleinic acid, but no protamin, instead of which a histon-like body was present. It is probable that *Arbacia* sperm chromatin is an histon nu-

cleate and more complex than fish-sperm chromatin. Neither bull or pig sperm contain protamin. The author suggests that the simplicity of fish-sperm chromatin is difficult to reconcile with Weismann's hypothesis.

Dr. Bashford Dean, in 'Notes on *Palæospondylus*,' gave a brief reply to Dr. Traquair's recent objections (Pro. Zool. Soc. Lond. March 16, 1897). The author notes:

(1) That the radial-shaped markings of the type specimen are certainly part of the fossil, since they occur in a second specimen now in the possession of Professor Stratford.

(2) That his broader interpretation of the 'unpaired nasal opening' (Traquair) as a nasomouth ring (as in *Myxine*) was an independent as well as a necessary one, as will appear in the full paper.

(3) That the view of the presence of the radial-shaped markings as the probable supports of paired fins, the relations of *Palæospondylus* to the Marsipobranchs, become even more hypothetical.

Dr. Matthew reported on the status of the Puerco fauna. A review of the Puerco fauna, based on Dr. Wortman's geological observations in the field and the records kept by the American Museum collecting parties, shows that the Upper and Lower Puerco beds do not contain a species in common, and only three or four genera pass through. The two faunas are entirely distinct. Dr. Wortman proposes to call the upper beds the Torregon formation, retaining the name Puerco for the lower beds.

Mixodectes, formerly supposed to be a primate allied to the modern *Chiromys*, is a true Rodent in the first stage of evolution. It has the characteristic Rodent astragalus, very like that of the earlier Sciuromorphs. The incisor is intermediate between the short, rooted spatulate incisor of most modern mammals and the long, rootless scalpriform incisor of the Rodentia. The root is long, but does not grow from a persistent pulp, and the crown is long and pointed, but still retains much of the spatulate shape. The canine and anterior premolars are disappearing, the fourth premolar becoming molariform, and the molars showing some traces of an impending change to a type like that of the Wasatch rodents.

More complete material of many species shows that all the placental mammals were remarkably similar in skeleton structure. They were plantigrade, pentadactyl, with claws or narrow hoofs, short, clumsy limbs and long, heavy tail. Contrary to expectation, the podium and metapodium are not usually arranged in serial order. The carpus is alternating in the four species in which it is known, and the tarsus is serial in only two out of eleven species. Of these two, one is a primate, the other is the ancestor of *Phenacodus* and has an alternating carpus. The direct ancestors of the Perissodactyls and Artiodactyls do not seem to be among the known Basal Eocene species. The Creodont *Clænodon* resembles the modern bears in foot structure as well as in the teeth, and may have been ancestral to them. Considering that such widely different types as the Edentates, Rodents, Primates and Amblypods have been traced to their first beginnings in the Basal Eocene, it may be concluded that the first differentiation of all the Placental mammals took place at the beginning of the Tertiary and not in the Cretaceous as has frequently been stated. Dr. Matthews' paper was discussed at length by Professor Osborn and Dr. Wortman.

Mr. Harrington reported on some observations which he had made on 'Earth Worms during Copulation.' He described an organ which apparently had been usually overlooked. This organ, the spermatophore of some authors, consists of a modified seta, much enlarged at the extremity and functioning, as Mr. Harrington suggests, to force spermatozoa into the seminal receptacles of the other worm.

GARY N. CALKINS,
Secretary of Section.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of St. Louis on the evening of November 15, 1897, Professor F. E. Nipher presented informally some of the results of recent experiments on the stability of a pivotally mounted sheet in an air stream, his experiments having been performed by exposing the pressure planes on the roof of a moving box car.

WILLIAM TRELEASE.
Secretary.